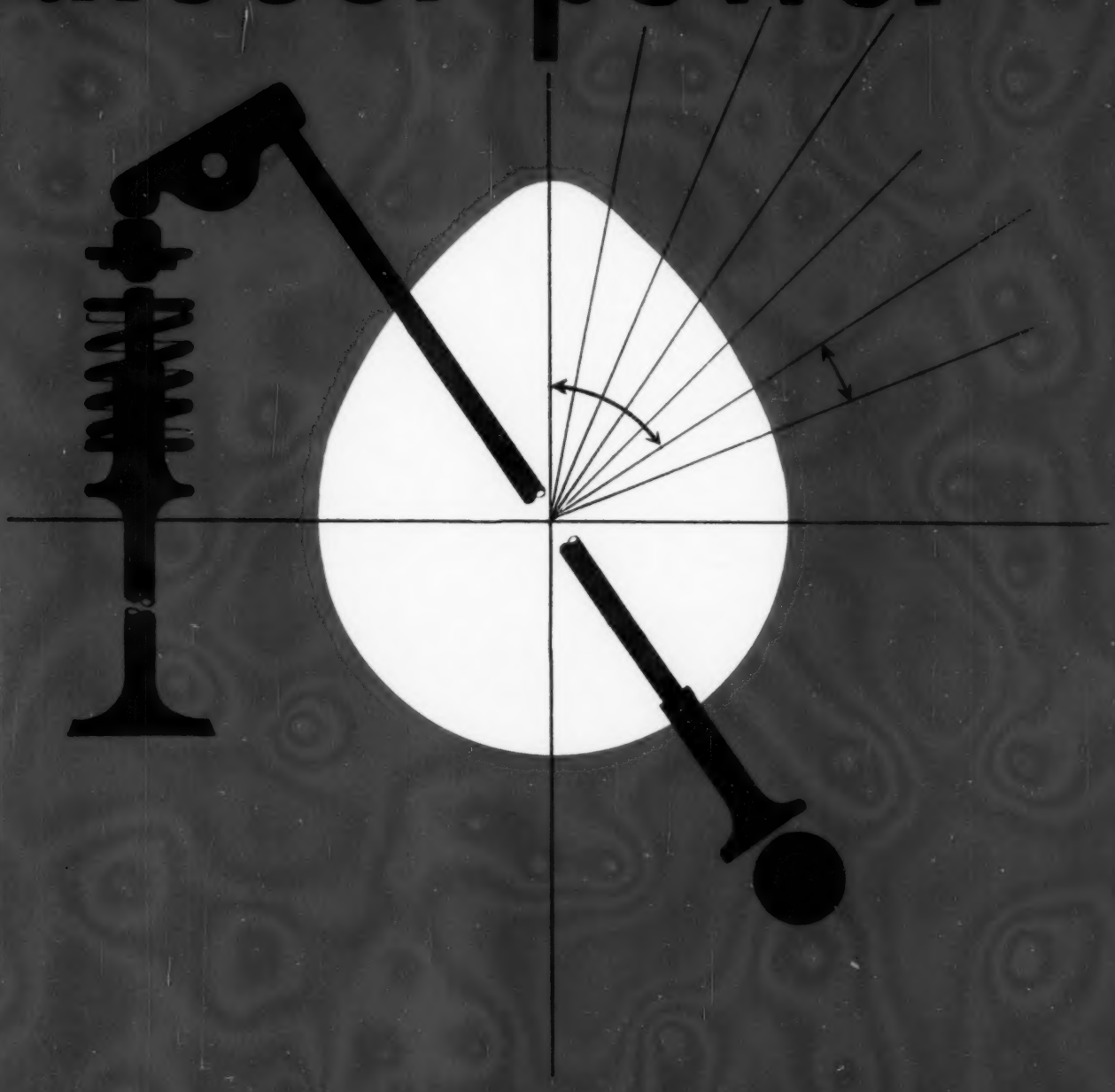
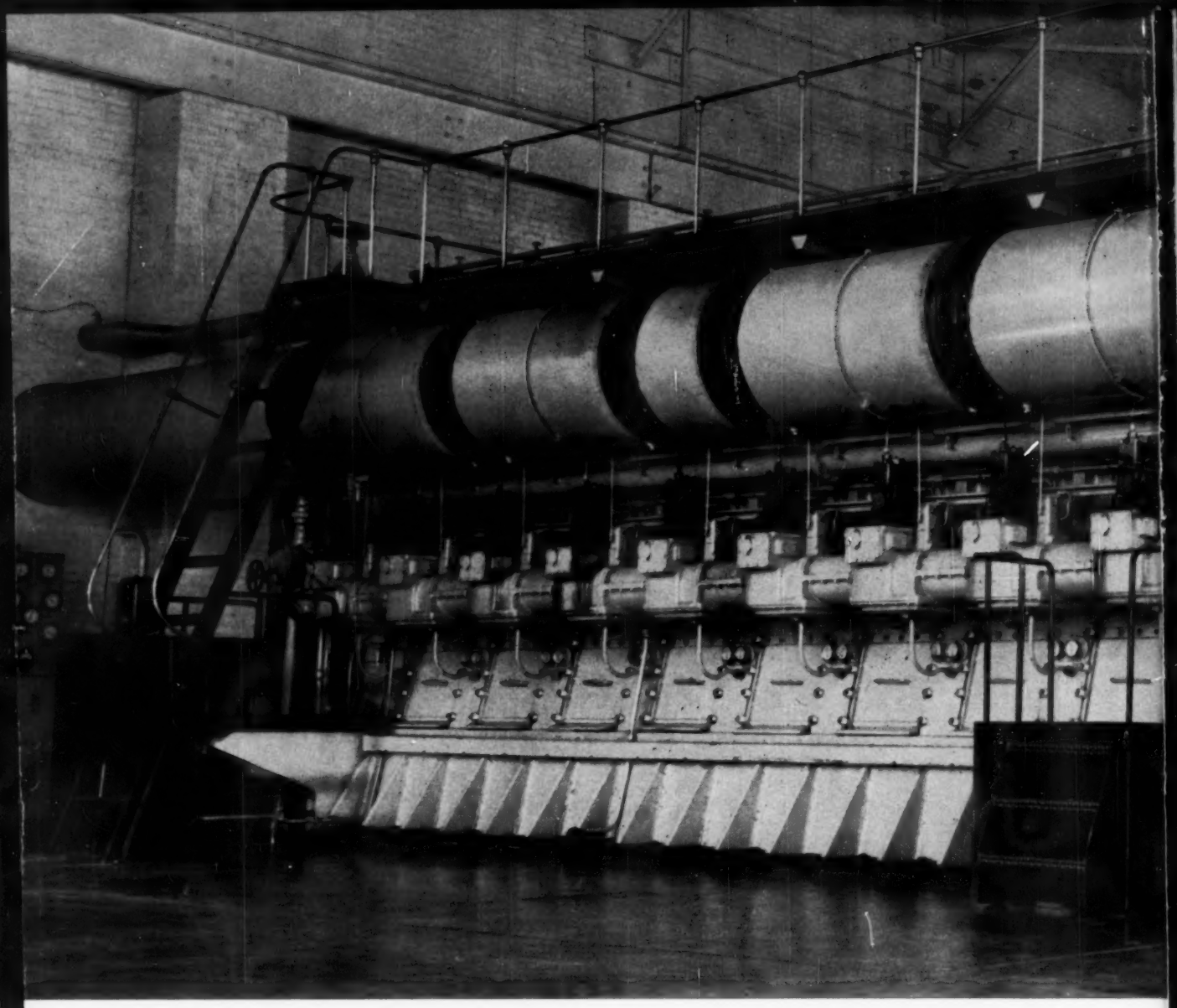
May 1957

diesel power





MORE POWER

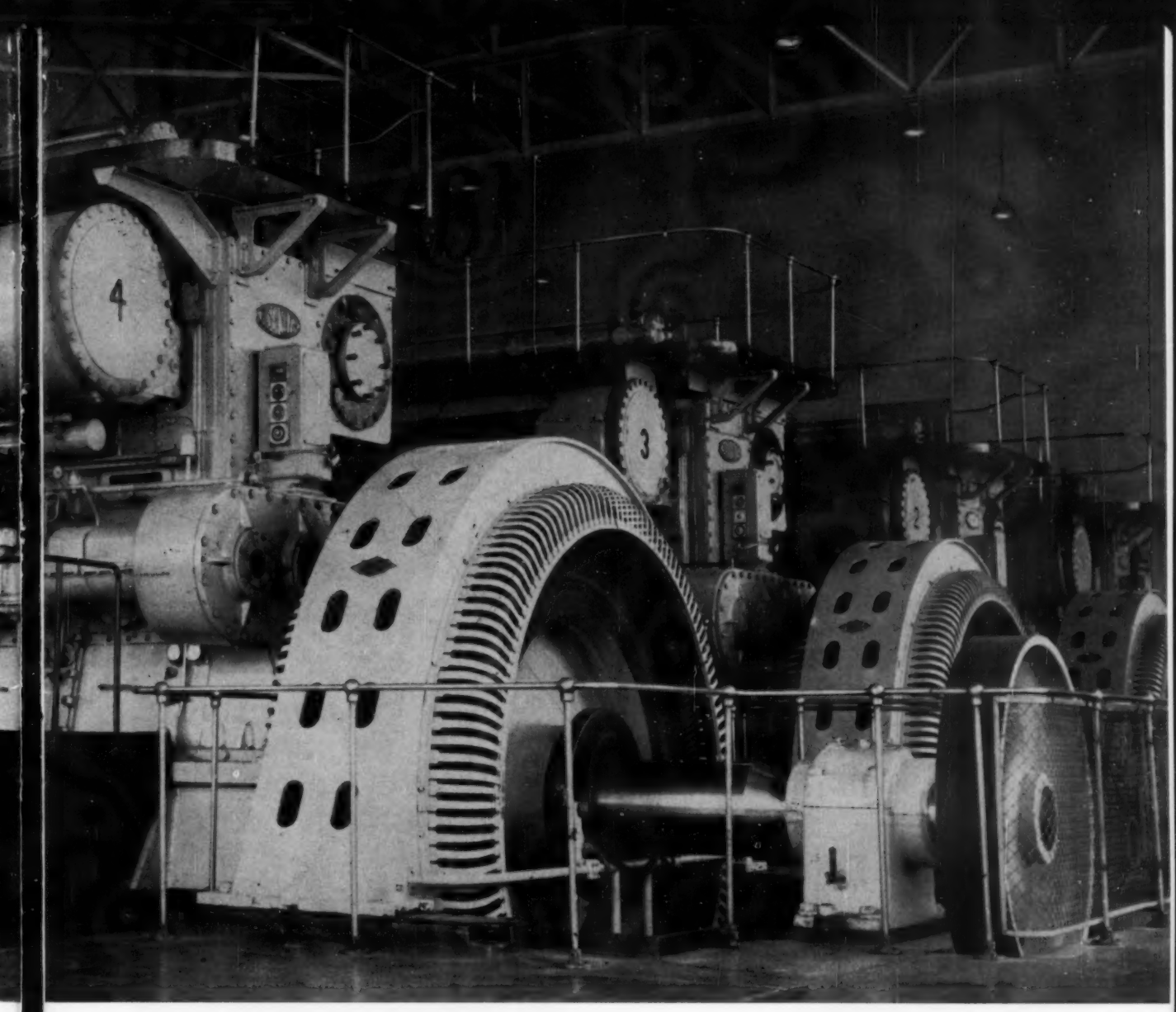
with the proper Texaco lubricants

It is not enough to say simply that, for over 20 years, more stationary diesel horsepower in the United States has been lubricated with Texaco than with any other brand.

Fact is, *Texaco Ursa Oils* are specifically refined and formulated for diesel, gas and dual-

TEXACO

TEXACO



to your diesels on less fuel

fuel engines; they are working oils whose detergent and dispersive actions protect moving parts from rust, oxidation and abrasion, help deliver more power on less fuel and at a greater saving in maintenance cost.

Let a Texaco Lubrication Engineer show you which *Texaco Ursa Oil* can help your engines to deliver more, clean power on less fuel. You can reach him at one of the more than 2,000 Texaco Distributing Plants in the 48 States—or by writing to The Texas Company, 135 East 42nd Street, New York 17, N. Y.

URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

THE MOST IMITATED PISTON IN THE WORLD...

8 years of PROVEN PERFORMANCE

ESTABLISH THESE NEW INDUSTRY STANDARDS...

1 LOWER OPERATING COSTS

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NIRESIST IRON ARMORED TOP RING BAND INTEGRALLY CAST AND CHEMICALLY BONDED TO ALUMINUM PISTON

DUALOY MEETS EVERY DEMAND FOR

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IN GASOLINE - DIESEL - LPG HEAVY DUTY ENGINES

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THE 1st BI-METALLIC MOLECULAR BONDED PISTON

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standardize on **CLEVITE 77*** bearings

extra stamina for high-duty service

NAPA Assurance of Quality

Your NAPA Jobber is a Good Man to Know!

Monmouth

ENGINE BEARINGS

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CLEVITE SERVICE

The Cleveland Graphite Bronze Co.
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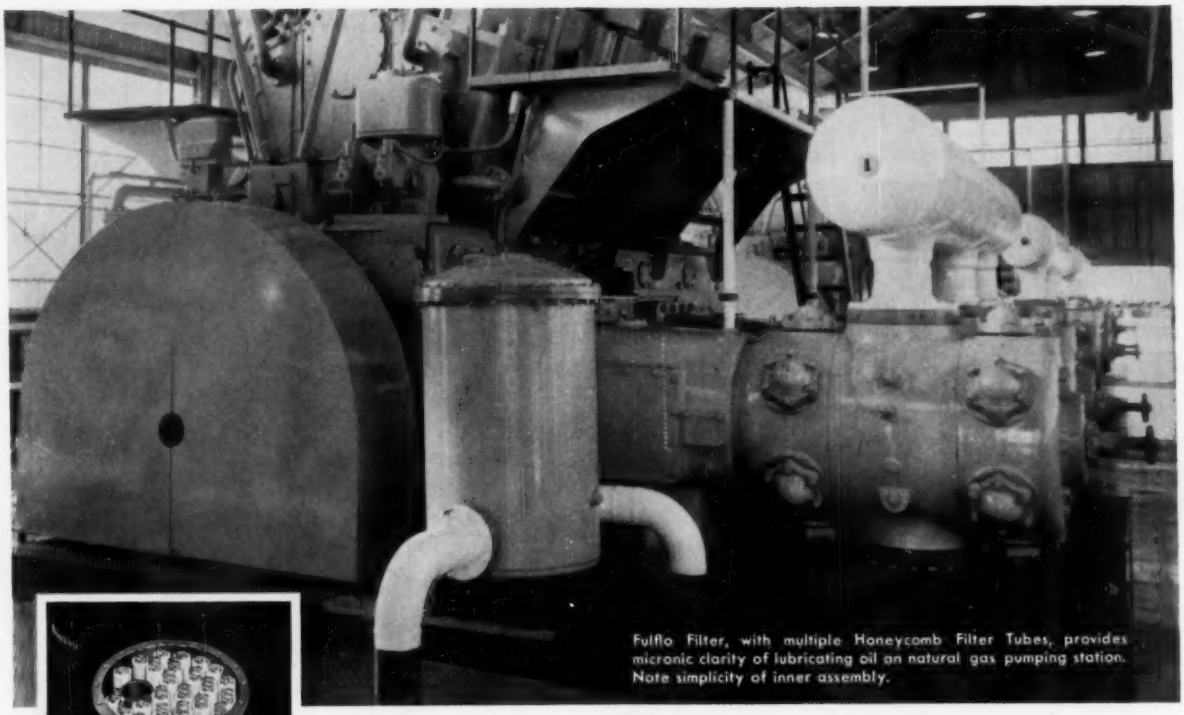
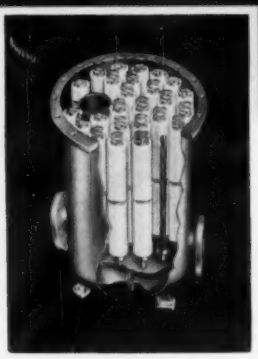


Fulflo Filter, with multiple Honeycomb Filter Tubes, provides micronic clarity of lubricating oil on natural gas pumping station. Note simplicity of inner assembly.



Fulflo Filters pioneered to give you longer engine life... low cost maintenance

Fulflo was the first successful application of a full-flow lubricating oil filters on high horsepower diesel engines. Now, Fulflo Filters provide micronic clarity of both fuel and lubricating oil for all sizes of stationary engines, mobile equipment and for bulk filtration. You save through reduced wear on injectors, reduced bearing wear, lower maintenance costs.

Exclusive Honeycomb Filter Tubes give you true depth filtration to any desired degree of micronic clarity. Densities are positively controlled in manufacture. Low-cost Honeycomb Filter Tubes are easy to replace. Don't accept substitutes!

CFC

CFC Oil Filters (including former Honan-Crane models) employ a variety of filter media for removal of soluble as well as solid impurities. Multi-cartridge Filter (illustrated) offers a choice of six types of interchangeable cartridges depending on type and degree of filtration desired. CFC Michiana Filters, with "throw-away" or repackable elements, provide especially low-cost filtration.

For engineering assistance or technical literature, write Department DR

Micro-Fine Filtration for Low Cost Clarity

COMMERCIAL FILTERS CORPORATION

MELROSE 76, MASSACHUSETTS

Plants in Melrose, Massachusetts and Lebanon, Indiana

FULFLO FILTERS WITH GENUINE HONEYCOMB FILTER TUBES FOR CONTROLLED MICRONIC CLARITY • CFC MULTI-CARTRIDGE OIL FILTERS
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diesel power

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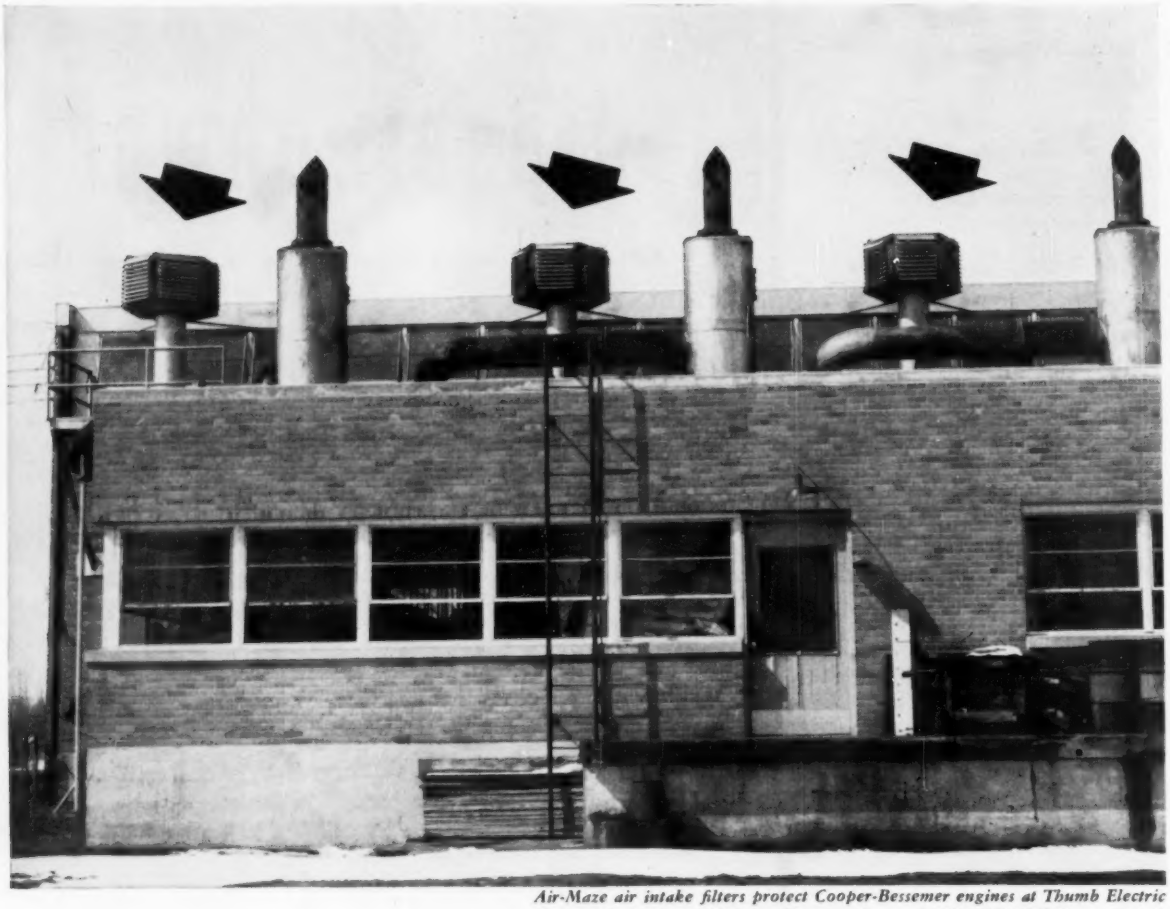

Air-Maze air intake filters protect Cooper-Bessemer engines at Thumb Electric Cooperative's Caro, Michigan Plant—winner of 1956 REA Efficiency Award.

For peak engine efficiency specify Air-Maze air filters

EFFICIENT filtration of intake air is only one factor in keeping gas and diesel engines running at peak efficiency—*but a mighty important one!*

Air-Maze Type F oil bath air filters provide positive protection against harmful dirt entering engine air intakes. These filters are easy to install, simple to service. Many such Air-Maze filters installed over twenty years ago are still operating, without ever having required a replacement part.

Endorsed and used by all leading engine builders, Air-Maze offers the widest choice of types including:

Automaze self-cleaning curtains and LPD cylindrical oil bath filters for large volumes of air, extremely low pressure drop.

Stack-type oil bath filters for smaller air volumes on mobile equipment.

Multimaze and DH panel assemblies for adequate impingement filtration where dirt loads are low and low initial cost is a factor.

Electromaze electronic air cleaner for removal of sub-micronic dust.

For new all-line catalog write Air-Maze Corporation, Cleveland 28, Ohio.

AFI MEMBER AIR FILTER INSTITUTE

The biggest names in diesels are protected by Air-Maze filters

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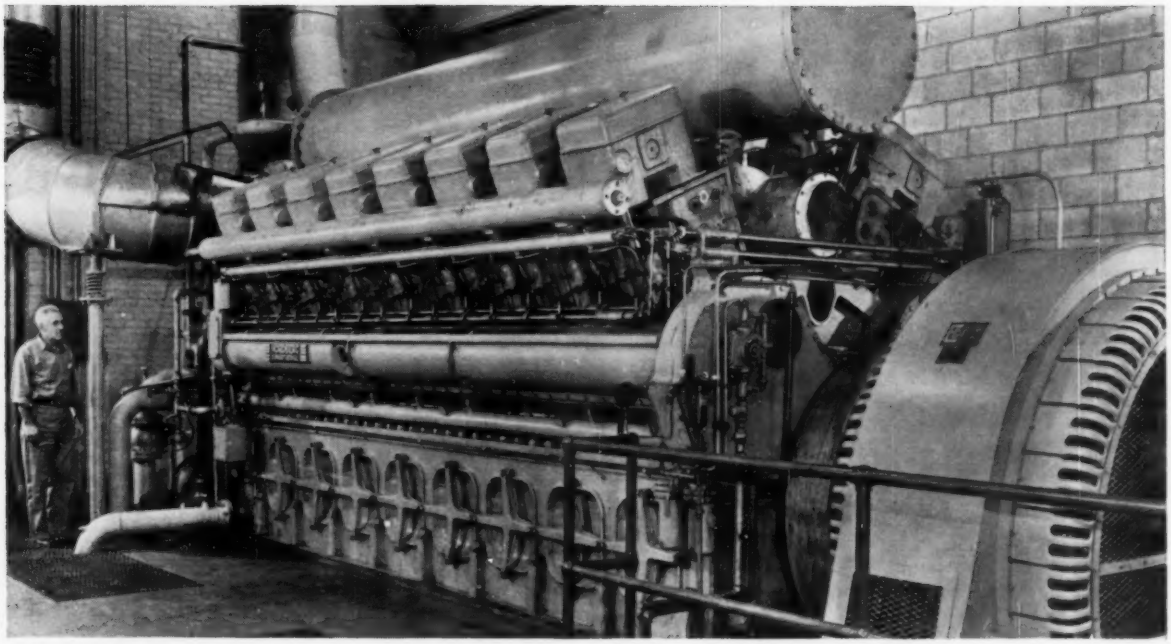
SILENCERS
SPARK ARRESTERS

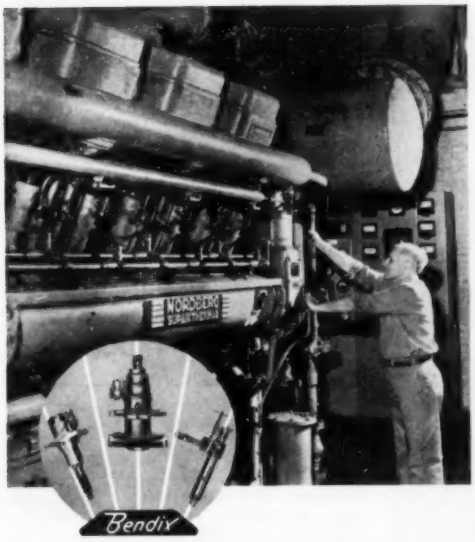
AIR-MAZE
The Filter Engineers

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS



Woodstock, Illinois, keeps power flowing with

NORDBERG DUAFUEL® ENGINE EQUIPPED WITH BENDIX FUEL INJECTION



With a completely independent electric power system, the town of Woodstock, Illinois, takes no chances on power failures. That's why the city fathers recently purchased a Nordberg Supairthermal® Duafuel engine to supplement existing steam turbine equipment. The engine, like many built by Nordberg, is equipped with Bendix* Fuel Injection pumps.

Originally intended as a stand-by unit, the Nordberg engine has more than fulfilled its purpose. So efficient has it proved that it has frequently been used as a base load unit. Far from being relegated to emergency use only, it has seen more and more regular service, and its moderate fuel consumption makes it the most economical unit in the plant, especially for short peaking purposes.

Citizens of Woodstock are happy with their independent power system. They like the revenue it brings in to support their city government (revenue that the new Bendix-equipped Nordberg engine is helping to increase), and, more than that, they like the uninterrupted service, regardless of weather. Bendix is pleased that its fuel injection system used on the Nordberg engine is helping keep this progressive Illinois city supplied with dependable power at reasonable prices. *REG. U.S. PAT. OFF.

SCINTILLA DIVISION OF BENDIX AVIATION CORPORATION, SIDNEY, N. Y.
Export Sales and Service: Bendix International Division, 205 East 42nd St., New York 17, N.Y.

Scintilla Division
SIDNEY, N. Y.

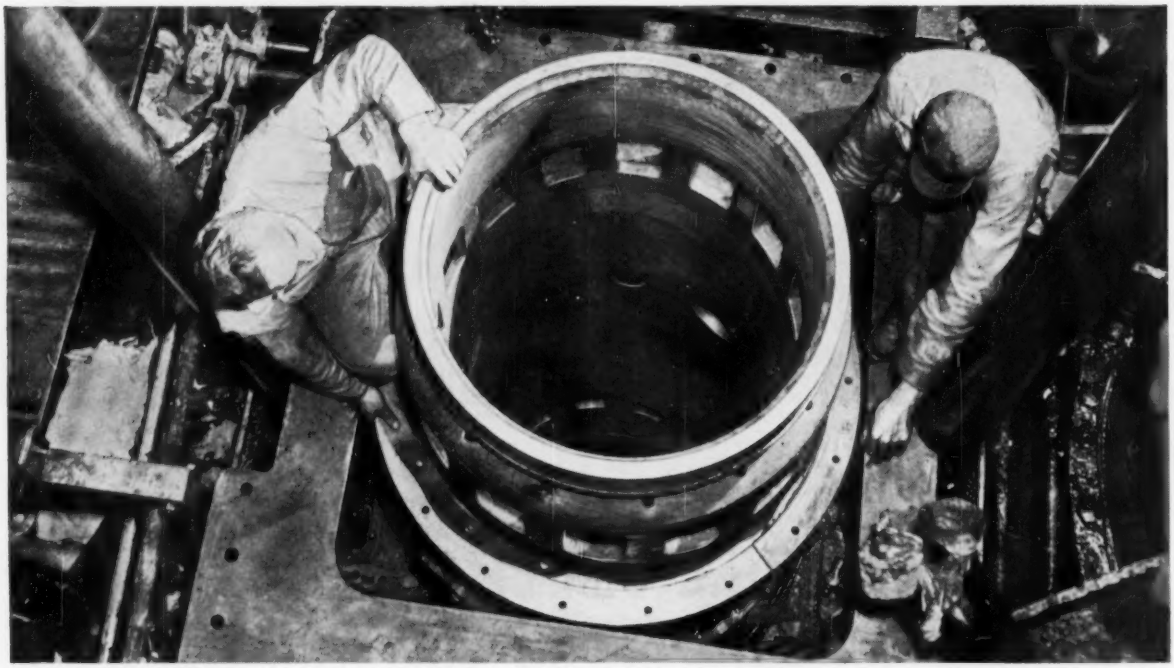
Bendix
AVIATION CORPORATION

ENGINEER'S FIELD REPORT

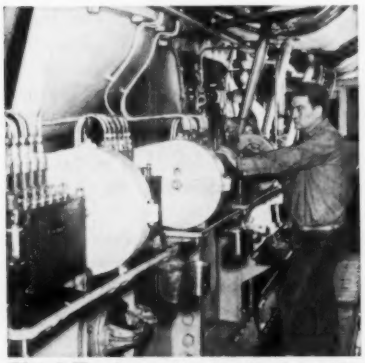
LUBRICANT RPM DELO MARINE OIL

FIRM PACIFIC FAR EAST LINES, INC. San Francisco, Calif.

Liner wear only .0012″ per 1000 hrs. with RPM DELO Oil



Giant Cylinder Liner lubricated with RPM DELO Marine Oil showed only a .0372" wear when recently replaced after 31,660 hours operation. That's an average of only .0012" per 1,000 hours! The 32" bore, 95" stroke cylinder liner is one of five such units in the 7,500 bhp Sun-Doxford diesel propulsion engine of Pacific Far East Line's M.V. Sea Serpent. A modified C-2 vessel, ship carries refrigerated cargo between Pacific Coast and Far East. Cruising at 15½ knots, she makes a round trip in six weeks.



Chief Engineer H. H. Forbes (left), checking cylinder-lubricators and scavenger pump, reports "RPM DELO" prevents lacquer formation on cylinder liners. View through crankcase inspection port (right) reveals temporarily disconnected piston, kept bright and shining, free of deposits by RPM DELO Marine Oil. Special detergent in the oil keeps engines clean, helps prevent scuffing, even when heavy residual fuels are used.

Why RPM DELO Marine Oil reduces engine wear

- Oil film stays on engine parts—hot or cold, running or idle
- Anti-oxidant resists lacquer formation—prevents deposits that stick rings
- Compounding inhibits deposits—solves residual fuel problems in low-speed marine diesels—cleans dirty engines, helps prevent scuffing
- Inhibitors prevent bearing corrosion, foaming in wet or dry sump engines.

For More Information about this or any other petroleum product, or the name of your nearest distributor, write or call any company below.

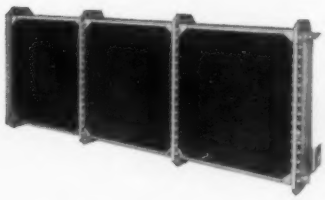
LUBRICATING OILS RPM DELO

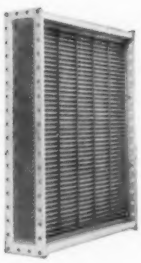
TRADEMARK "RPM DELO" AND DESIGN REG. U.S. PAT. OFF

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey

STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA COMPANY, Denver 1, Colorado

Cool trail for the Rocket!





TEMPERATURES MADE TO ORDER

ROCK ISLAND'S ultra-modern streamliner cooled by **HARRISON!**

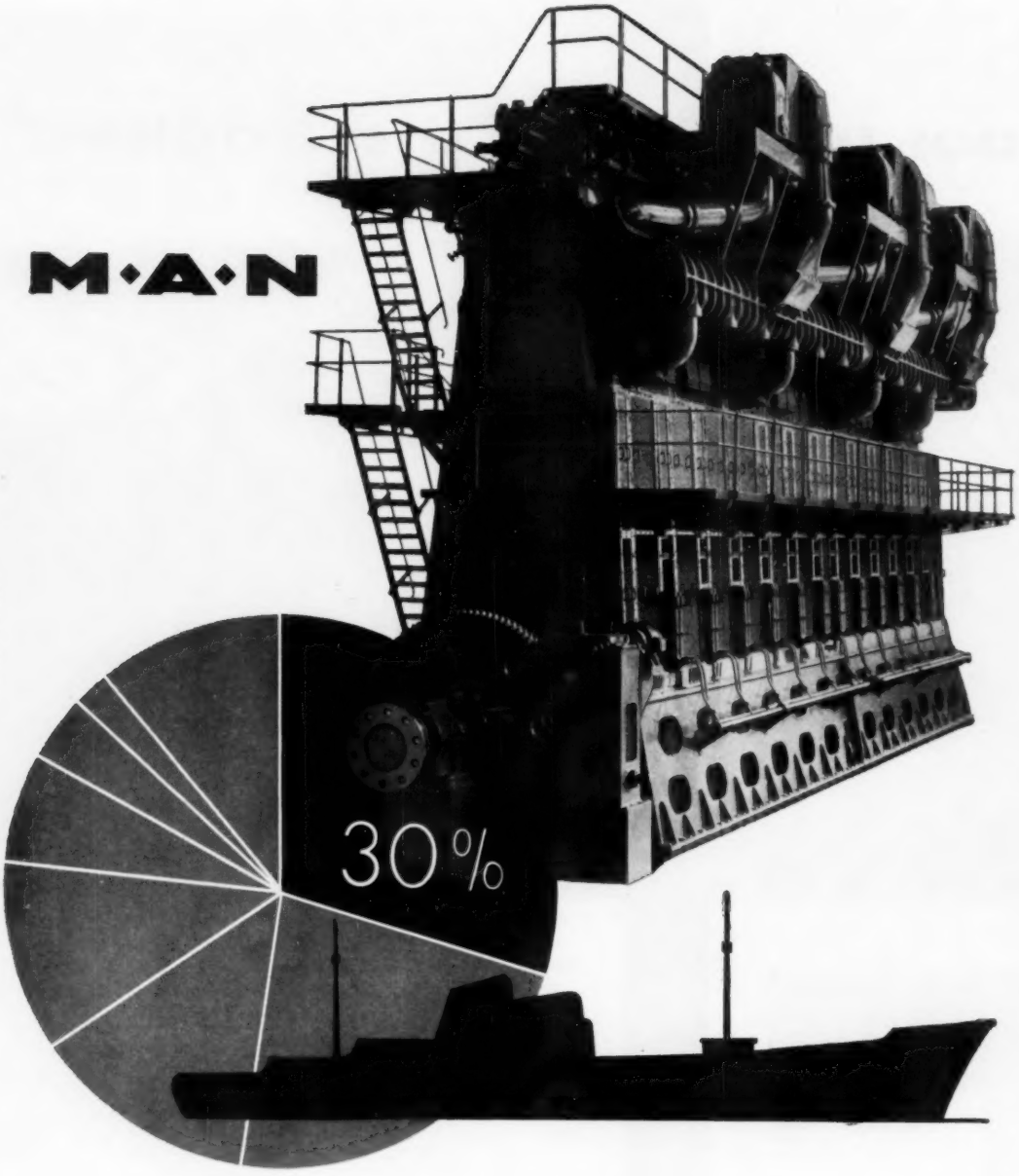
The Rocket's en route . . . and right on schedule! The Rock Island's famous streamliner blazes by village and town . . . racing with time . . . and on top of the heat *all the time.* For Harrison tracks down temperatures for the long haul. These heavy-duty lube oil and jacket water coolers keep heat down . . . keep engines running at peak performance. Harrison coolers are rugged, reliable and compact . . . ready for duty on today's most modern diesel engines. That's why Harrison heat exchangers ride the majority of modern locomotives today. If you have a cooling problem, look to Harrison for the answer.

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N. Y.

GM GENERAL MOTORS

HARRISON

M·A·N

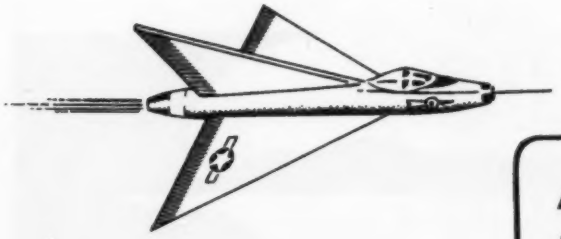


Of 477 motor vessels built in 1956 with carrying capacities over 2000 tons d.w.c. M.A.N. and their licensees equipped 141 ships with engines, i.e. 30 per cent. 86 of these 141 ships received original M.A.N. engines so that every fifth motor vessel over 2000 tons d.w.c. built in 1956 operates with original engines of the Augsburg Works. Total output of large marine diesel engines built by the Augsburg Works of M.A.N. in 1956 amounts to 360,110 BHP.

(According to "The Motor Ship", January 1957)

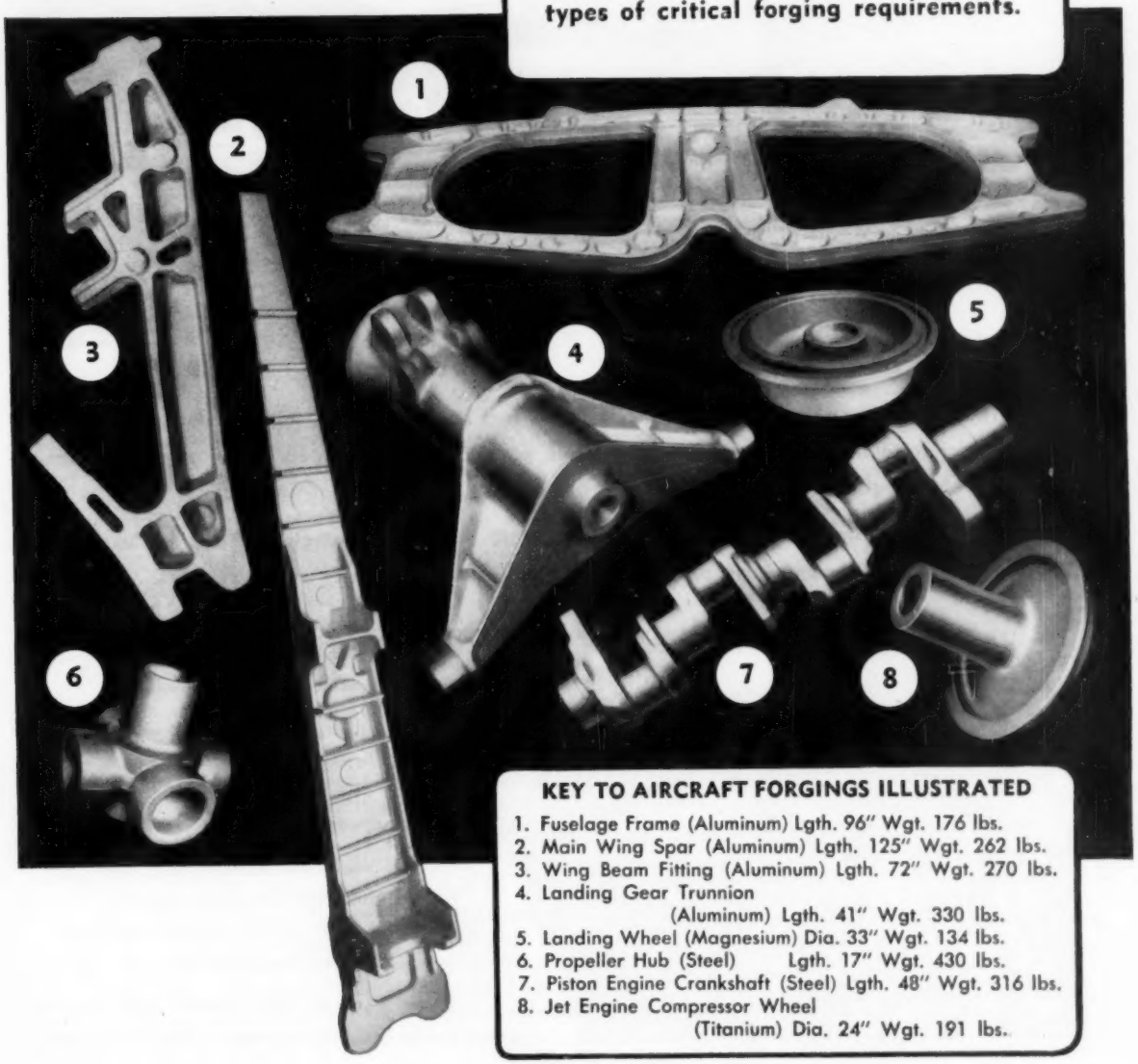
MASCHINENFABRIK AUGSBURG-NURNBERG AG · AUGSBURG

REPRESENTED IN ALL COUNTRIES



DEPENDABILITY...

Aviation engineers and designers since the beginning of the Aircraft Industry have relied on Wyman-Gordon for all types of critical forging requirements.



KEY TO AIRCRAFT FORGINGS ILLUSTRATED

1. Fuselage Frame (Aluminum) Lgth. 96" Wgt. 176 lbs.
2. Main Wing Spar (Aluminum) Lgth. 125" Wgt. 262 lbs.
3. Wing Beam Fitting (Aluminum) Lgth. 72" Wgt. 270 lbs.
4. Landing Gear Trunnion (Aluminum) Lgth. 41" Wgt. 330 lbs.
5. Landing Wheel (Magnesium) Dia. 33" Wgt. 134 lbs.
6. Propeller Hub (Steel) Lgth. 17" Wgt. 430 lbs.
7. Piston Engine Crankshaft (Steel) Lgth. 48" Wgt. 316 lbs.
8. Jet Engine Compressor Wheel (Titanium) Dia. 24" Wgt. 191 lbs.

WYMAN-GORDON COMPANY

Established 1883

FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM

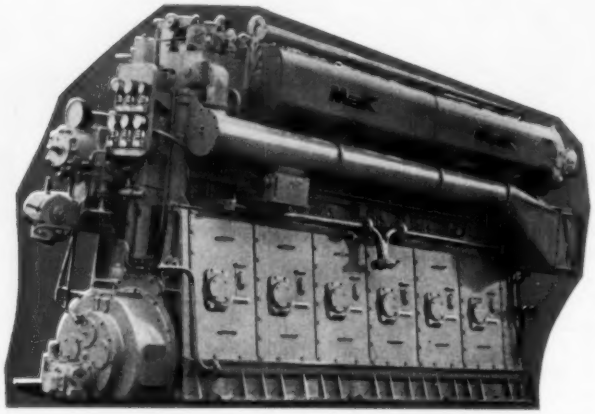
WORCESTER 1, MASSACHUSETTS

HARVEY, ILLINOIS • DETROIT, MICHIGAN

AT ALL TIMES, ONLY SHIPS

equipped with a reliable engine run economically. This fact becomes of special importance in the fishing industry since here the constantly changing loads when towing drag nets require an extremely rugged and reliable engine.

Many fishing vessels the world over are equipped with MaK M582 Series engines. They are exceptionally strong in all vital parts and have proved their reliability and economy on all voyages.



Some technical data of the M582 Series engine presented below should be of special interest to you.

Horsepower Range: 750 to 1920 HP
Speed Range: Up to 300 RPM
Bore: 15.16 IN: Stroke: 22.83 IN
Mean Piston Speed: 1142 FPM

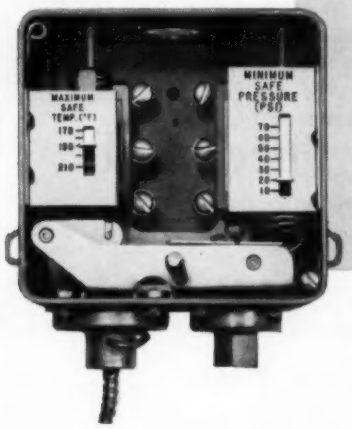
Four-Stroke Cycle—Direct Fuel Injection—Individual Injection Pumps—Sturdy Tie-Rod Construction Column-Type Structure

Customer service and licensed shop facilities are available in many big sea and inland harbors.

MaK

MASCHINENBAU KIEL AKTIENGESELLSCHAFT
GERMANY

Temperature and pressure set points are inside the case, protected against accidental manipulation. Cover is removed for easy adjustment.



New Diesel engine safety switch

...gives fail-safe protection

This all-new Honeywell safety switch responds to abnormal pressure or temperature to stop or idle a diesel engine, or actuate an alarm circuit.

It combines separate systems for measuring engine coolant temperature and lubricating oil pressure. The temperature system includes an exclusive fail-safe feature, so that in case of damage to its temperature bulb, capillary or diaphragm, the switch responds as it would to excessive temperature.

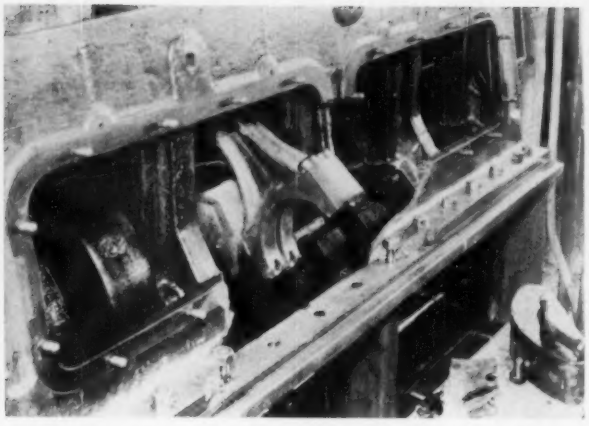
Temperature and pressure settings can't drift off set points. There can be no false shutdowns due to vibration. Set points are easily adjustable in the field.

Your nearby Honeywell sales engineer will be glad to give you complete information about the new Diesel Engine Safety Switch. Call him today . . . he's near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pennsylvania—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA: Write for Specification sheet S1010-5 "Diesel Engine Safety Switch."**

MINNEAPOLIS **Honeywell**
BROWN INSTRUMENTS
First in Controls



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DIESEL FUEL and LUBRICATION

BULLETIN

CITIES SERVICE

WHAT CAUSES LUBRICATION FAILURES?

The biggest single reason for lubrication failure is improper selection and application of lubricants.

Today's lubricating oils are made for highly specialized purposes. The fact that an oil seems ideal for the requirements of one piece of equipment is no guarantee of its qualifications for other machinery.

For example, choice of an oil with low detergency may result in stuck rings, excess cylinder wear, injector clogging, bearing wear and other diesel difficulties.

Next time you're considering what type of oil to use for a certain piece of equipment, call in a Cities Service Lubrication Engineer. He not only has the precise oil for the particular unit you want to lubricate, but may be able to simplify your entire lubrication picture and reduce maintenance costs as well.

USERS ACCLAIM CITIES SERVICE C-300 OIL

From a strip miner comes this report: "Shovel and dragline work 20 hrs. a day, seven days a week. Each have rolled up over 14,000 hrs. with no major overhaul, using Cities Service C-300 Motor Oil."

From a leading stone company: "Our six stationary diesels, powering our compressors and crushers, have averaged 12,000 hours each before major overhaul, with Cities Service C-300 Oil."

From a trucking company: "Our 20 diesels get up to 225,000 miles before overhaul with Cities Service C-300 Oil. We don't even grind the valves before then."

With excellent oxidation resistance, high detergency, and low carbon residue, Cities Service C-300 Oil may be the perfect lubricant for your machinery, too.

Get the facts from a Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

USING A SULPHUROUS FUEL? TRY THIS NEW CITIES SERVICE OIL

If you're using a diesel fuel with high sulphur content, your motor oil must do more than its normal share of work to fight engine deposits.

Cities Service C-100 Motor Oil has been formulated for just this purpose. Under dusty, dirty, and sulphurous conditions, it provides excellent engine lubrication and protection. Talk with your Cities Service Lubrication Engineer for details.

MAN YOU SHOULD KNOW

Barney Fleming is the Regional Manager of Industrial Oil Sales at the Cities Service office in St. Paul, Minnesota. With a background of 35 years as a lubrication engineer and a talent for solving problems, he is typical of the Cities Service engineering staff that's at your service. A call to the nearest Cities Service office will bring a member of this staff to your plant or job site.

"Factory approved" diesel fuel injection service... available everywhere

Prompt, efficient, and reliable service by American Bosch Authorized Fuel Injection Service Stations. Here, factory-trained experts are equipped with special tools and test equipment to give you fast, accurate repair work using genuine American Bosch replacement parts. Use your nearest American Bosch Service Station. It's a service that will save you time and money . . . and keep your diesels on the go.

Here's a complete list of Authorized American Bosch Fuel Injection Service Stations—the largest network of sales and service agencies in the industry. Tear it out and keep it for a handy reference.

ALABAMA

BIRMINGHAM, 3	Birmingham Electric Battery Co.

ARIZONA

CASA GRANDE	Diesel-Electric Service Co.
COOLIDGE	Slater Auto Supply
MESA	Perkins Diesel Service
PHOENIX	Charlie C. Jones Battery & Electric Co.
TUCSON	Auto Plane Electrical Service
YUMA	Yuma Automotive Electric

ARKANSAS

DE WITT	Graves Electric Company
N. LITTLE ROCK	Womack Bros. & Taylor

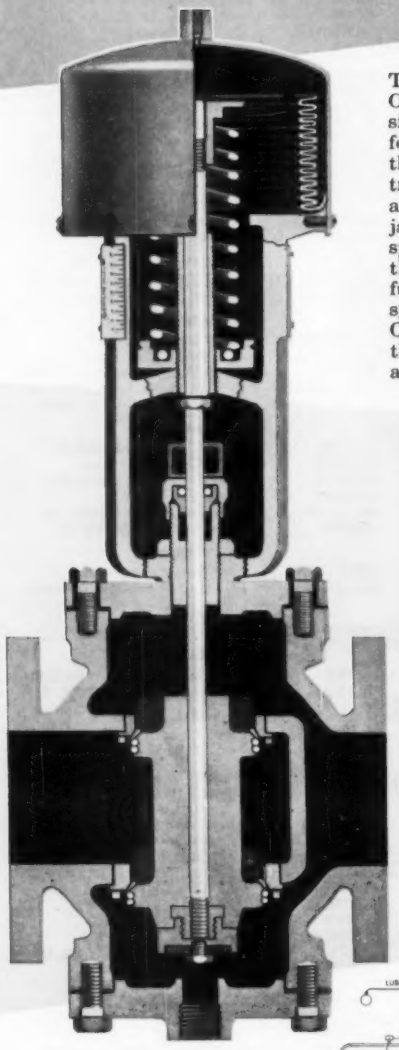
CALIFORNIA

BAKERSFIELD	Automotive Diesel & Electric Co., Inc.
EL CENTRO	Valley Automotive & Diesel Service Co.
EUREKA	Gustafson Diesel & Electric
FRESNO	Winther Bros.
HUNTINGTON PK.	Auto Electric Service
LOS ANGELES	Diesel Precision Co., Inc.
LOS ANGELES, 21	Magneto Sales & Service Co., Inc.
OAKLAND	Diesel Injection & Governor Service Inc.
OAKLAND	Pimental & Son
REDDING	Shasta Truck & Injection Service
SACRAMENTO	Diesel Pump & Injector Service
SACRAMENTO, 6	Langner & Rifkin
SALINAS	Haag Diesel & Electric
SAN BERNARDINO	Diesel Injection Service
SAN DIEGO	Electric Diesel & Equipment Co.

SAN FRANCISCO, 24	McKinley Corporation of California
SOUTH GATE	Diesel Fuel Injection Lab
STOCKTON	Connell Motor Parts
WILMINGTON	Diesel Control Corp.
COLORADO	
DENVER, 3	Central Auto Electric Company
GRAND JUNCTION	Flannery Electric Service
MONTE VISTA	Joe Riggenbach
PUEBLO	Motor Accessory and Parts
CONNECTICUT	
HARTFORD	W. J. Connell Co. of Hartford
NEW HAVEN	Clark-Son Co., Inc.
DELAWARE	
MILTON	Benson's Fuel Injection
DISTRICT OF COLUMBIA	
WASHINGTON	Diesel & Ignition Service Inc.
FLORIDA	
FT. LAUDERDALE	Broward Diesel Co., Ltd.
JACKSONVILLE	Diesel Electric Service, Inc.
JACKSONVILLE	Patten Sales Co., Inc.
MIAMI	Dade Diesel Company
MIAMI, 36	Florida Diesel Service Co.
MIAMI, 37	Nieman-Wilson, Inc.
ORLANDO	Interstate Diesel Service
TAMPA	Stuart Diesel Service
GEORGIA	
ATLANTA, 3	Auto Electric & Magneto Co.
CAIRO	Grady Motors
IDAHO	
BLACKFOOT	Auto Parts Service Co.
BOISE	Magneto & Diesel Supply Co.
LEWISTON	Osterman Diesel & Electric Co.
TWIN FALLS	Diesel Pump & Injector Service
ILLINOIS	
CHICAGO, 16	Illinois Auto Electric Co.
MENDOTA	Walzer's Diesel Service
MT. CARMEL	Deck Hill Battery Company
PEORIA	Automotive Ignition Co.
ROCK ISLAND	Lohse Automotive Service
INDIANA	
INDIANAPOLIS, 4	Gulling Auto Electric Inc.
MENTONE	Smith Brothers Garage
VALPARAISO	Diesel Service Company
IOWA	
DES MOINES	Electrical Service & Sales Co.
MARSHALLTOWN	Heuer Equipment
KANSAS	
CALDWELL	Diesel Injection Service Co.
GARDEN CITY	Bell Diesel Injection Service Co.
GREAT BEND	Bell Engine Service
GRINNELL	Grinnell Electric & Diesel Service Co.
HUTCHINSON	Reno Sales & Service
SALINA	The Motor Service Company
WICHITA, 2	E. S. Cowie Electric Co.
KENTUCKY	
LOUISVILLE	Diesel Injection Service
LOUISVILLE	Schaaf Auto Electric Co.
PADUCAH	Story Electric & Battery Co.
LOUISIANA	
BATON ROUGE	Womack Bros. Diesel Service
BOSSIER CITY	Vaughan Tractor & Auto Parts Co.
MORGAN CITY	Landry & Simoneaux
NEW ORLEANS	Gerhardt's Inc.
NEW ORLEANS, 13	John M. Walton, Inc.
MAINE	
BANGOR	American Gear Company
PORTLAND	Eastern Diesel Service Co.
PORTLAND, 5	Portland Tractor Co., Inc.
MARYLAND	
BALTIMORE	Mechanical Engineering Co.
BALTIMORE, 1	Parks and Hull Automotive Corp.
BALTIMORE	Stephen Seth & Co.
MASSACHUSETTS	
BOSTON	Boston Fuel Injection & Engine Service
BOSTON, 64	W. J. Connell Company
BOSTON, 10	Wharf Machine & Electric Co., Inc.
FAIRHAVEN	Hathaway Machinery Co., Inc.
SPRINGFIELD	C. A. Krohne & Sons
MICHIGAN	
DETROIT	Knorr-Maynard, Inc.
GRAND RAPIDS	Peninsular Engineering & Sales, Inc.
LANSING	Diesel Equipment Sales & Service
MINNESOTA	
ALBERT LEA	Smith Tire & Electric Company
HIBBING	Diesel Service Company
MANKATO	Mankato Service Company
MINNEAPOLIS	Diesel Service Co.
MISSISSIPPI	
JACKSON	Womack Brothers
MISSOURI	
KANSAS CITY, 8	Electrical & Magneto Service Co.
ST. LOUIS, 23	Diesel Fuel Injection Service Co.
ST. LOUIS, 3	Electric Parts and Service Co.
MONTANA	
BILLINGS	Original Equipment, Inc.
HAVRE	Midwest Diesel Injection Sales & Service
NEBRASKA	
HEMMINGFORD	Worley Diesel Service
McCOOK	Automotive Sales & Service
NORTH PLATTE	Reitan Service Company
OMAHA, 2	Carl A. Anderson, Inc.
NEW JERSEY	
NEWARK, 2	Tire Trading Company, Inc.
SOMERVILLE	Battery & Electric Service Co.
TRENTON, 9	Steinert Diesel Injection Service
NEW MEXICO	
ALBUQUERQUE	Central Auto Electric Company
NEW YORK	
BROOKLYN	A & D Diesel Service, Inc.
BUFFALO, 8	Hettrich Electric Service
HEMPSTEAD, L. I.	A & D Diesel Service, Inc.
PELHAM MANOR	Coretti-Gross, Inc.
ROCHESTER	Union Carburetor & Ignition Service
TROY	Ehrlich Electric Service, Inc.
UTICA	Stiefvater Electric Co., Inc.
WOODSIDE, 77	American Bosch Div. American Bosch Arma Corp.
NORTH CAROLINA	
CHARLOTTE	Diesel Injection Sales & Service
CHARLOTTE	Diesel Injection Hydraulic Service
RALEIGH	Diesel Injection Sales & Service
NORTH DAKOTA	
DICKINSON	Mann's Automotive Supply
FARGO	Midland Diesel Service & Engine Co.
GRAFTON	Grafton Auto Electric Company
MINOT	Diesel Service Company
WILLISTON	Crighton Motor Co.
OHIO	
AKRON	Standard Motor Parts
CINCINNATI	Tri-State Distributing Corp.
CLEVELAND, 8	The Cleveland Ignition Co.
COLUMBUS, 15	Columbus Ignition Co.
DAYTON, 4	Dulina Diesel Fuel Injection Equipment Sales & Service Co.
LISBON	Lisbon Diesel & Supply Co., Inc.
OKLAHOMA	
ENID	Dinsmore-Cowie Company
OKLAHOMA CITY, 2	American Electric-Ignition Co.
PONCA CITY	Auto Electric Company
TULSA	Magneto Ignition Company
OREGON	
KLAMATH FALLS	Specialized Service Co.
MEDFORD	Haupert Diesel Service
PENDLETON	Eds Magneto & Diesel Co.
PORTLAND, 14	Automotive Products, Inc.
ROSEBURG	Diesel Injection Service
PENNSYLVANIA	
CHAMBERSBURG	Aden L. Hawbaker
HARRISBURG	Penn Diesel Service Co.
HAZLETON	Penn Diesel Service Co.
MT. CARMEL	Gengler's Diesel Service & Sales
PHILADELPHIA	North American Diesel Injection Co.
PHILADELPHIA	Sullivan Brothers
PHILLIPSBURG	Keystone Diesel Injection Service
PITTSBURGH, 6	Automotive Ignition Co., Inc.
SOUTH CAROLINA	
CHARLESTON	Diesel Fuel Injection Service
COLUMBIA	Boney Diesel Works Co., Inc.
SOUTH DAKOTA	
LEMMON	Josund Auto Electric
RAPID CITY	Hoseth Auto Electric
SIOUX FALLS	Dakota Diesel Service Co.
TENNESSEE	
KNOXVILLE, 15	Diesel-Magneto Service Co.
MEMPHIS, 4	Automotive Elec. Service Co.
NASHVILLE	Precision Parts Corp.
TEXAS	
BEAUMONT	Diesel Engine & Pump Co.
CORPUS CHRISTI	Magneto & Diesel Injector Service
DALLAS, 1	Beard & Stone Electric Co., Inc.
EL PASO	Reynolds Batt. & Mag. Co.
HOUSTON, 1	Beard & Stone Electric Co., Inc.
HOUSTON	Diesel Pump & Injector Service
HOUSTON	Magneto & Diesel Injector Service
ODESSA	Electric Service & Supply
PAMPA	Radcliff Bros. Electric Co.
SAN ANTONIO	S. X. Callahan
SAN ANTONIO	Womack Bros.
UTAH	
SALT LAKE CITY	Diesel Electric Service & Supply Co.
SALT LAKE CITY	Midwest Service & Supply Co.
VIRGINIA	
HARRISONBURG	Valley Distributors, Inc.
LYNCHBURG	M. & R. Diesel Service
NORFOLK	Diesel Injection Sales and Service
RICHMOND	C. H. Woodward Electric Co., Inc.
SALEM	Diesel Injection Sales & Service
WASHINGTON	
SEATTLE	Seattle Injector & Electric Co.
SPOKANE	Gas & Diesel Truck Shop
SPOKANE	Spokane Diesel & Electric Co.
SPOKANE	Sunset Electric Co.
WALLA WALLA	Walla Walla Motor Supply, Inc.
YAKIMA	Diesel & Electric Service Co.
WEST VIRGINIA	
CHARLESTON	Mountain Service
WHEELING	Diesel Injection Sales & Service Co.
WISCONSIN	
MILWAUKEE	Fuel Injection & Electric Co.
WYOMING	
CASPER	Cotter Battery & Electric Company
MILLS	Diesel Service Company
ALASKA	
ANCHORAGE	Reeve Alaska Airmotive
JUNEAU	Van's Diesel Service
CANADA	
CALGARY	Hutton's, Ltd.
EDMONTON	Diesel Service (1954), Ltd.
EDMONTON	Smith Battery & Auto Electric
FREDERICTON	Stairs Bros.
HALIFAX	Stairs Bros. Reg'd.
LONDON	Universal Ignition & Battery, Ltd.
MONTREAL	International Electric Co., Ltd.
MONTREAL	Northam Equipment, Ltd.
OTTAWA	Welch & Johnston, Ltd.
PETERBOROUGH	A. C. Curtis, Ltd.
QUEBEC	Quebec Gas & Diesel Engines, Ltd.
REGINA	Electric Motor Service
ST. JOHN'S (Newfoundland)	A. H. Murray & Co., Ltd.
SASKATOON	Lambert Electric, Ltd.
SUDBURY	Yuill & Craig
TORONTO	A. Cross & Co., Ltd.
TORONTO	Auto Electric Service Co., Ltd.
TORONTO	Westway Auto Electric, Ltd.
VANCOUVER	Fred Holmes Fuel Injection Sales & Service, Ltd.
VANCOUVER	Jeffree & Jeffree, Ltd.
VANCOUVER	Vivian Diesels & Munitions, Ltd.
VERNON	J. S. Galbraith & Sons
WINNIPEG	Brown & Murray, Ltd.
HAWAII	
HONOLULU	Honolulu Iron Works Company
HONOLULU	Kawaiahao, Ltd.
HONOLULU	Todoki Machine & Marine Works
PUERTO RICO	
SAN JUAN	General Equipment Corp.

AMERICAN BOSCH
DIVISION
AMERICAN BOSCH ARMA
CORPORATION
SPRINGFIELD 7, MASS.

NEW VALVE PROTECTS 3 WAYS
. . . STOPS GAS ENGINES QUICKLY



This new Sylphon Pressure-Operated Valve now makes possible faster, all-round protection for gas engines. Team it up with the Sylphon No. 530 Safety Control, and you can stop worrying about low lube pressure, high jacket water temperature, or overspeed. If any one exceeds the limit, this valve tightly seals off the fuel supply and vents the fuel system for immediate shut-down. On top of that, it is so versatile that you can plug the vent port and use it for many other services.

Special Sylphon® seamless bellows assures continuous valve operation. No seams to break and leak. In addition, it's made in two plies . . . easily withstands control air pressures up to 40 psi.

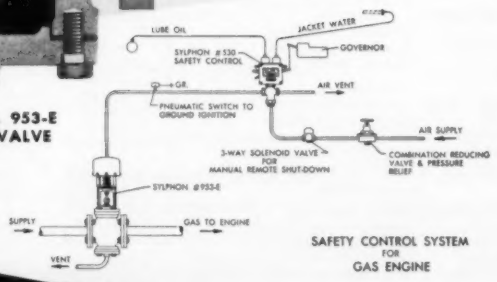
Pressure to open or close valve ports can be quickly adjusted simply by turning a disc below the spring. Clearly-marked scale shows adjustments at a glance.

Composition O-ring seals and renewable disc give "bubble-tight" sealing of both the main ports and the vent port.

Available in 2" and 3" valve sizes for air, gas, water or oil. Operating pressure can be as high as 65 psi. Bodies bronze or steel.

FULTON SYLPHON NO. 953-E PRESSURE-OPERATED VALVE

SEND FOR DATA SHEET JD-953-E



SAFETY CONTROL SYSTEM FOR GAS ENGINE

Mr. Controls

Robertshaw-Fulton

CONTROLS COMPANY

FULTON SYLPHON DIVISION • Knoxville 1, Tenn.

In 1883, Gottlieb Daimler built the world's first high revolution gasoline engine.

In 1884, Karl Benz obtained the world's first patent for a motor vehicle.

In 1926, these two pioneering manufacturers joined in a merger to form the present Daimler-Benz A. G., Stuttgart, West Germany.

Today, Daimler-Benz builds the world's finest automobiles — the Mercedes-Benz — and produces diesel powered trucks and tractors, and diesel engines from 10 to 3000 horsepower for marine, rail and industrial uses.

The company exports from Germany to 128 foreign countries through more than 1,100 agencies and distributors and operates assembly and production facilities in 27 foreign countries.

Daimler-Benz today employs 53,000 in Germany and an additional 13,000 outside Germany.

Sales in 1956 were $392,000,000.

In 1903, Orville and Wilbur Wright flew for the first time in history with an airplane and engine of their own design. Glenn H. Curtiss pioneered in aircraft development during the same period.

In 1929, the Curtiss-Wright Corporation was formed by merging the companies founded by the Wright Brothers and Curtiss.

Today, Curtiss-Wright is a leading producer of aircraft engines, missiles, propellers, electronic flight simulators, and other aircraft equipment for the military and the commercial airlines, as well as products in the fields of electronics, ultrasonics, nucleonics, thermodynamics, plastics and metallurgy. The fastest airliners in operation today are powered by Curtiss-Wright engines. A Curtiss-Wright rocket engine powered the Bell X2 to world speed and altitude records.

Curtiss-Wright employs 32,000 in 17 divisions and subsidiaries in the United States and two foreign countries and exports products throughout the world.

Sales in 1956 were $571,000,000.

Beginning as wagon manufacturers in 1852, the Studebaker Brothers produced a 16 horsepower gasoline powered car in 1904 at South Bend, Indiana.

In 1899, the Packard Motor Company produced a 12 horsepower car at Warren, Ohio.

In 1954, Studebaker-Packard Corporation was formed through a combination of these two companies. Today, Studebaker-Packard Corporation manufactures a complete line of passenger cars, trucks, and station-wagons which are distributed throughout the world and sold by more than 2,400 dealers in the United States and Canada. The company pioneered modern supercharged engines, low silhouette jet styling, twin-traction rear axles, torsion springing and finned, air-cooled brakes.

The company's products are assembled in plants operating in 11 foreign countries.

Studebaker-Packard Corporation employs 9,000 at South Bend, Indiana.

Sales in 1956 were $303,000,000.

DAIMLER-BENZ CURTISS-WRIGHT Studebaker-Packard

These three companies employing 107,000 people, with sales in 1956 totaling one billion, two hundred sixty-six million dollars, announce the signing of agreements providing for a fully-integrated program of engineering, production, sales and service of automotive vehicles; automotive, marine and industrial gasoline and diesel engines; and diesel and gasoline fuel injection systems. All of these companies have been associated for years with quality, precision manufacture and high-performance products.

Pursuant to these agreements, Daimler-Benz and Curtiss-Wright have formed an American company — Curtiss-Wright and Mercedes-Benz, Inc. — to provide for the development and sale of Daimler-Benz products in the United States, Canada, Mexico and Cuba.

Studebaker-Packard Corporation in signing the agreements will now make available to its dealers a full line of domestic and imported sports cars, convertibles, sedans and station wagons — ranging in price from under $2,000 up to $13,000 — gasoline and diesel powered trucks and all-wheel drive utility vehicles.

Mercedes-Benz cars and distinctive Mercedes-Benz features — such as fine coachwork, swing axles and transmissions — will be exclusive to Studebaker-Packard.

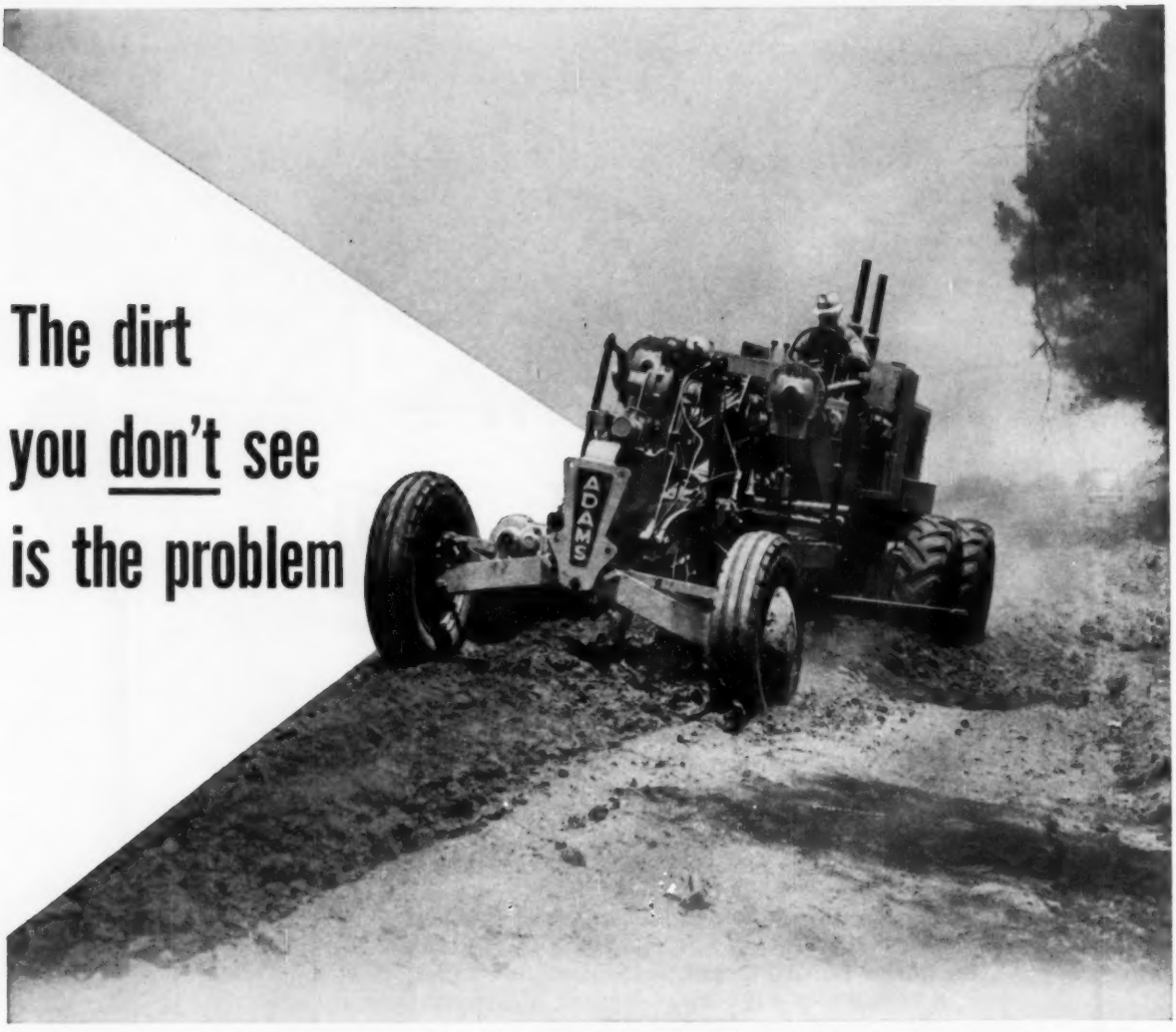
The Utica-Bend Division of Curtiss-Wright Corporation, now building diesel engines for the U. S. Navy, will import and manufacture Mercedes-Benz diesel engines and diesel and gasoline engine fuel injection systems under the agreements. The engines will range from a 4-cylinder model of 25 h.p. to a supercharged 8-cylinder model of 600 h.p.

Further agreements are being negotiated between Daimler-Benz and Curtiss-Wright Corporation for the interchange of rights for the manufacture of aircraft products.

Carl F. Giese
President, Daimler-Benz of North America, Inc.

Roy T. Hurley
Chairman and President, Curtiss-Wright Corporation

H. E. Churchill
President, Studebaker-Packard Corporation



Le-Tourneau-Westinghouse Adams "660" Grader, powered by 150 H. P. Diesel Engine

Dry Type Micronic® Air Filtration solves it

The tons of dirt this grader moves in a day don't give it any trouble at all. But just let a little of the dirt that's drawn in with the air intake get through to the engine and it'll stop dead in its tracks. That's why efficient air filtration is so vital to the operation of this equipment . . . why engine and equipment manufacturers have accepted PurOlator's new Dry Type Micronic® Air Filter as the most efficient yet developed.

Whether your engine is idling or revving at top speed, this new Purolator Air Filter removes 99% of all contaminants. That makes it virtually impossible for harmful abrasives to get into the precision parts of the engine no matter how dirty the job or where you're working. The Dry Type Micronic elements save time and effort in servicing, too. Elements can be replaced in one-tenth the time – and with one-tenth the effort – needed to service other types.

Purolator Catalog AFC-56 contains a valuable chapter "Facts about engine air requirements" that can help you prolong engine life and reduce repair bills. Send for your free copy today. Address Dept. OP9-111.

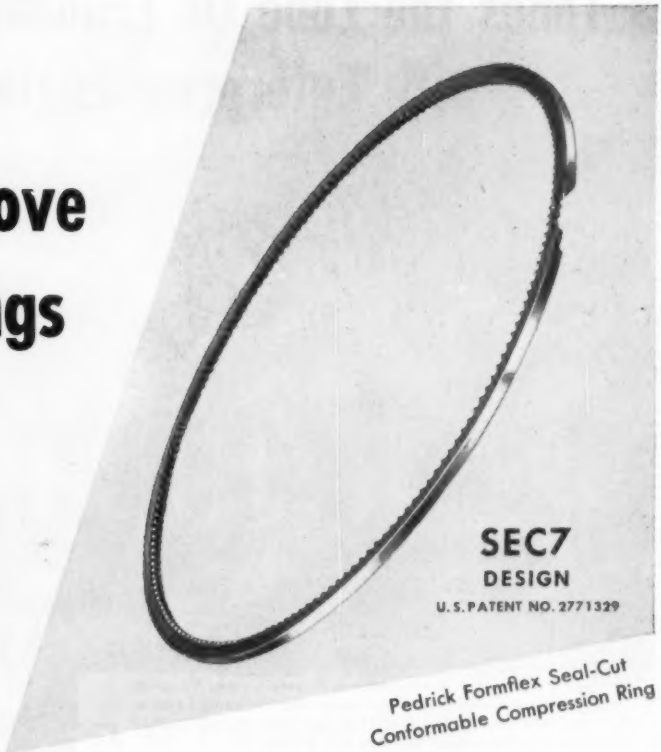
Filtration For Every Known Fluid

PUROLATOR

PRODUCTS, INC.

Rahway, New Jersey and Toronto, Ontario, Canada

Why Lower-Groove Compression Rings Need Supplementary Pressure



Pedrick Formflex Seal-Cut Conformable Compression Ring

The force or pressure of the compression and combustion gases back of the rings is one of the most important factors in keeping the compression rings pressing against the cylinder walls for a satisfactory seal. The tension built into the ring contributes to this, but in a relatively minor way.

The top compression ring enjoys the greatest assist from combustion-chamber pressures. The gas pressure available to the second ring is only what passes through the top-ring gap, and is substantially less than cylinder pressure. The pressure behind the 3rd ring is still further reduced. Thus, by the time the gas pressures reach the lowest compression ring usually there is not sufficient force to enable the ring to maintain a seal, and it is here that it is most important to maintain a seal to prevent the gases from going further.

The ring used in the lowest compression groove needs special assistance to do its job. This is provided in the Pedrick FORMFLEX Seal-Cut compression ring. It is a single cast-iron ring of much less radial thickness for greater conformability and response to pressures. Its special-design of overlapping ends close the gap completely. Its big assistance comes from the Pedrick "Equalizer" which backs it up and provides adequate additional outward pressure to seal at the cylinder wall and stop blowby. This pressure is exerted everywhere around the ring and is absolutely uniform.

The result is a ring conformable enough to follow cylinder-wall irregularities and with enough pressure to maintain an effective seal. Power is preserved. Contamination of the lubrication oil from blowby gases is avoided. There is no build-up of undesirable and potentially-dangerous gas pressures in the crankcase.

Why not get the full benefit of Pedrick's experience in the design and application of conformable compression, as well as conformable oil rings, to your big diesel and natural-gas engines? For engineering details on the application of conformable compression rings, write for Form 434. WILKENING MANUFACTURING CO., Philadelphia 42, Pa. In Canada: Wilkening Manufacturing Co. (Canada) Ltd., Toronto 2.

Pedrick PISTON RINGS

PEDRICK PIONEERED *Conformable* RINGS FOR BIG-BORE ENGINES

3 Times the Lube Oil Economy with Enterprise Engines at Lyman, Wyoming

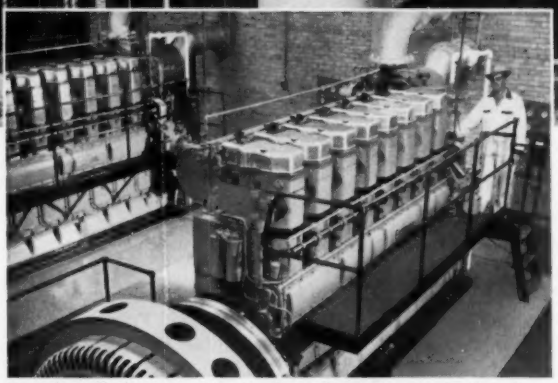
Bridger Valley Electric Association, Mountain View, Wyoming, operates this well-designed diesel power plant at nearby Lyman. Last two units were installed in 1952—both Enterprise DGSG-38 Dual Fuel Engines, rated 925 HP at 450 RPM.

23,597 BHP hours per gallon for entire REA Electric plant*
38,074 BHP hours for the Enterprise Dual Fuel Engines

—more than 3 times the lube oil economy reported by the next best plant!

This record of low lube oil consumption is nothing short of phenomenal. These are the facts from plant records and U.S. Government reports comparing the operating records of 30 REA plants.* It shows that the Lyman, Wyoming, electric co-op ranks first by far in lube oil economy. In every other comparison, too, the Bridger Valley Electric Association plant has established an enviable position through outstanding performance and efficient operation. Since the two Enterprise Dual Fuel Engines were added in 1952, they have virtually replaced the original plant units, which are now used only for peak load and standby service.

If your city or co-op is considering new power in its plan to modernize or expand, it will pay you to plan with Enterprise. Here is dependable, record-proven equipment in the field of heavy-duty diesel, dual fuel, tri-fuel and spark ignited gas engines, 73 to 7703 HP. Write us today for full information, or call your nearest Enterprise office.



Since installation, one of the two Enterprise Engines carries the primary load at all times, alternates with second Enterprise Turbocharged 8-Cylinder unit. Older plant engines are cut in as required during peak load periods. John Brinton is the operator.

Under capable management of William E. Riding, co-op has thrived. Enterprise Engine dependability is proved again: not one enforced shutdown in nearly 30,000 hours of combined operation!

Plant Superintendent Kyle Peterson says: *"Our record of low lube oil consumption is just one of the things we like about Enterprise. They're really fine engines by any comparison, give us everything we expect—and more!"*

*From U. S. Department of Agriculture, Rural Electrification Administration: "Operating Data of Certain REA-Financed Internal Combustion Generating Plants—January 1 to March 31, 1955."

Over a million horsepower at work the world over!

ENTERPRISE
dependable **ENGINES**

ENTERPRISE ENGINE & MACHINERY CO.
Subsidiary of General Metals Corporation
18th and Florida Streets, San Francisco 10, California
Export Department, San Francisco

Boston • Chicago • Des Moines • Fort Worth • Huntington • Jacksonville • Kansas City • Los Angeles
New Orleans • New York • Pittsburgh • San Diego • Seattle • St. Louis • Washington, D. C.

This diesel ran on a heavy fuel that fooled the laboratory men

IMPROVED FILTERABILITY provided by Du Pont FOA-2 is evidenced by the filters pictured here. The economy fuel clogged filters as shown by the one on the left, in only one week's time. The clean filters functioned several weeks in a fuel treated with FOA-2.

A heavy cat-cracked recycle stock spelled trouble for one large railroad —the kind of trouble you sometimes expect with residual blends. The fuel clogged engine filters in a week's time.

In hope of putting an end to this, the railroad sent samples of the fuel to Du Pont for study. On the basis of laboratory tests, we concluded that Du Pont Fuel Oil Additive No. 2 (FOA-2) should improve the fuel in service. What the laboratory men thought should happen, *did* happen —only more so.

Results exceed expectations

After three weeks of service—in engines fueled with the heavy recycle stock containing FOA-2—the filters were cleaner than would be normally expected with *standard* fuel. Actually, the engines ran to a 35-day changeout on the filters without any loss of filterability.

Reduces clogging and sticking

You can solve most filter-plugging problems with Du Pont FOA-2. Its excellent dispersant, stabilizing and solubilizing actions protect against residue formation. It acts to decrease the rate of insoluble residue build-up and so prevents filter-plugging and injector-sticking. FOA-2 not only minimizes sludge formation; it often cleans parts where sludge has begun to build up.

It's easy to test Du Pont FOA-2 in your own stocks. Field results may exceed *your* expectations. Samples and technical information are available from your Du Pont Petroleum Chemicals Division technical representative. Contact him for further details.

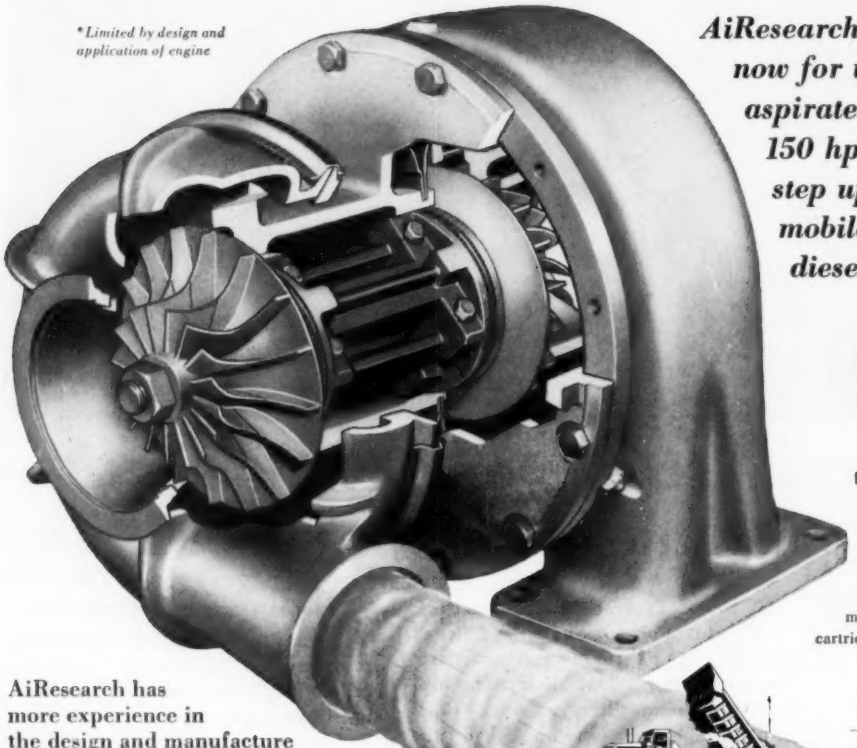
DU PONT
REG. U.S. PAT. OFF.
Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

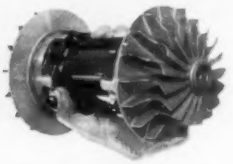
E. I. DU PONT DE NEMOURS & CO. (INC.) · Petroleum Chemicals Division · Wilmington 98, Delaware

AiResearch Turbochargers improve diesel engine performance up to 100%*

**Limited by design and application of engine*

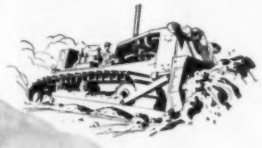


AiResearch units are available now for use with normally aspirated diesel engines of 150 hp and up. They step up performance of both mobile and stationary diesels, land or marine.



Removable cartridge simplifies repair and overhaul

This cartridge contains the turbocharger's rotating assembly, bearings and seals in a factory balanced package. It can be replaced in minutes with another factory balanced cartridge by a mechanic on the scene.



AiResearch has more experience in the design and manufacture of small turbomachinery than any other company. AiResearch turbochargers are the most efficient and safest units of their kind. New additions to the AiResearch family of turbochargers have widened their range of application in the diesel engine industry.

Our engineers welcome the opportunity to work with you in improving the performance of your diesel engines. We are happy to confer on applications of the turbocharger principle to your power plants.

AIRESEARCH TURBOCHARGERS NOW AVAILABLE				
MODEL	F-51	C-60	A-60	E-100
Diameter — in. nom.	10	11.5	15.25	15.1
Length — in.	10.5	12.9	16.75	14.7
Weight — lb.	40	95	125	112
Output — lb/min. (Standard Conditions)	29-51	30-60	38-60	50-100

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND RELATED MACHINERY

editorially speaking

"Long Service Life" Boobytraps

A friend recently boasted that his car had gone 80,000 miles and "never had the head off". We drove it and believed him. It was a dog! Either he was willing to accept the poor performance and cost of inefficiency or didn't recognize it. We wouldn't put up with it. So actually, maximum wear tolerances are largely a matter of how much inefficiency you will stand. In commercial service, you better key your maintenance scheduling to performance—based on inspection with today's excellent test equipment—or you'll wind up with only a hollow boast of an in-service "record" to justify exorbitant maintenance bills. Here's another case found while browsing through a diesel maintenance book. The author cites an engine that did some 300,000 miles during which nothing was done to the bearings. When stripped down, the crankshaft mains were 0.017-in. undersize. Four of the crank pins were 0.004-in. under and the two others, 0.006-in. under. Main bearings were worn 0.003-in. and rod bearings showed no wear except one that was 0.002-in. under. This is a testimonial of something but we're not sure of what. We've always thought that if something was to wear it should be the cheaper part—here, the bearings. The main journal wear figure looks bad enough to be a typographical error. But cranks wore faster than the rod bearings too. If it were our engine, we'd want to know that the bearings were too hard for the shaft hardness or if they were babbitt bearings, they were loading up with imbedded dirt. You could do something early in the game; not after 300,000 miles. Understand, we're all for long service life but *not* at the cost of overall economy. The minute that you go beyond accepted service periods, the baby is on your doorstep. Clinical inspection with modern instruments (most of them are not elaborate or costly) will enable you to get best service life with safety. Without this approach you may set some sort of record, only to find you've boobytrapped yourself when the time comes that you have to face up to reality.

B P E

Rub-out the 5 most troublesome diesel ring problems!

Sealed Power Cyclan Piston Rings

dispatch these problems with finality
They break in fast—wear . . . and wear . . . and wear

Sealed Power engineers will welcome an opportunity to discuss Cyclan Rings and their application to your problem. If more convenient, write for "The Cyclan Story."

"It's Great to Live in Michigan"
MICHIGAN WEEK, MAY 19-25

SEALED POWER CORPORATION • MUSKEGON, MICHIGAN • ST. JOHNS, MICHIGAN • ROCHESTER, INDIANA • STRATFORD, ONTARIO
DETROIT OFFICE • [illegible] GENERAL MOTORS BUILDING • PHONE [illegible]

Sealed Power Piston Rings

PISTONS • CYLINDER SLEEVES

Leading Manufacturer of Automotive and Industrial Piston Rings Since 1911
Largest Producers of Sealing Rings for Automatic Transmissions and Power Steering Units

highlights

How to get roadbuilding programs rolling faster received top-level attention when Governors from 11 western states met on April 26-27 in Reno, Nevada, according to the ARBA.

Conversion to diesels for fork lifts is spreading abroad. A British user of Towmotor units reports substantial savings when they converted to diesel engines. Conversion kits with 3-cyl Perkins diesels were used.

The vital role of trucks as servants in everyday life and in industry was pictured in the April 15 issue of Life Magazine. It's a good public relations job on the part of American Trucking Foundation. The convincing motor freight transport story was a seven-page advertisement paid by 140 trucking industry suppliers.

Big Consolidated Freightways, Inc. gets bigger through internal expansion, some acquisition and diversification. Routes cover from Los Angeles and Phoenix to Fairbanks, Alaska, and east as far as Dayton, Ohio. They also are engaged in design, manufacturing and assembly of the "White Freightliners" through arrangement with White.

General Electric predicts use of electronic brains to speed oil well drilling. The application of computers was suggested, says Bryant Trenary, GE engineer, by recent outstanding successes with the operation of electric transmissions on diesel-electric drilling rigs. They have long range plans, he adds, for exploring the use of computers in analyzing drilling conditions and automatically transmitting directions to drilling rigs.

Lag in Federal Roadbuilding Program is claimed by some manufacturers. Bureau of Public Roads officials say no. Industry reactions are mixed with both good and bad reports on current sales in the heavy equipment field. Two factors emerge: High inventories of certain equipment, tractors for one, encourage contractors to delay purchase until actual need; bad weather has roadbuilding off to a slow start and delayed need.

Truck builders, currently without diesel models, are taking a closer look at diesel power potentialities. At least one manufacturer is reportedly doing some major redesigning to accommodate a diesel engine option in its larger trucks.

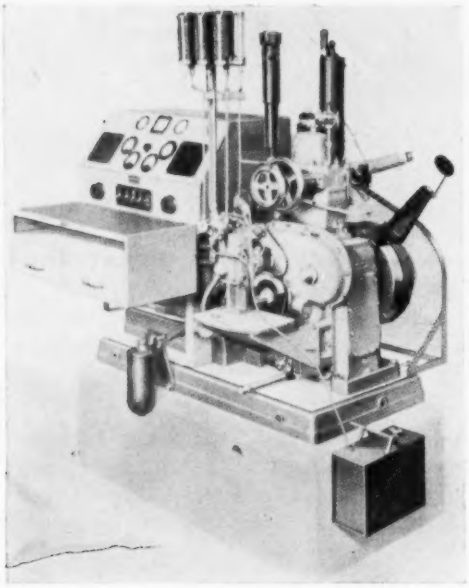
International Harvester has a full-time departmental section which works with engineering on cost reduction of product. This news was relayed by an SAE Production Forum panel on Cost Reduction Programs.

Curtiss-Wright/Mercedes-Benz deal has now jelled. Rights to import, manufacture and sell Mercedes-Benz diesels and fuel injection systems, have been obtained by C-W. The work will be done at the Utica Bend Division.

Metallurgy holds the answer to most of today's high temperature and corrosion problems in modern high-output engines. International Nickel Co. "Nickel Topics", pointing to Ni-Resist alone, lists its use and benefits in exhaust manifolds, turbocharger casings, piston inserts and exhaust valve guides.

Influence of trucking on our economy is tremendous. About one-twelfth the Nation's Gross National Product, or more than $34 billion was spent by the trucking industry in 1955 for wages, fuel, equipment and other items. This significant fact was reported by "American Trucking Trends", ATA.

Divisions of "The Big Three"—Chevrolet, Ford and Chrysler—have greatly accelerated development and testing programs for gas turbine engines in heavy-duty trucks. Work is experimental and commercialization a long way off. With transportation playing such a critical and costly part in today's economy, the more good minds working on its problems the better. So figures Pacific Intermountain Express. As concrete encouragement to bigger and better brains in the industry, they offer ten $250 scholarships each year. Latest award goes to Henry M. Karel, senior transportation major at Northwestern University.



This Waukesha Model CFR-48 test engine can have its compression ratio changed by screwing an expansible plug in or out of the combustion chamber. The unit is used to check ignition delay of fuel samples.

Engines You May Never See

You may not see them and they produce no useful work in the sense that your engines do—but every diesel running has benefitted by the developments resulting from use of these test engines.

THERE are certain diesel engines built which you'll never see in field operation. Yet the benefits obtained from these test engines are vital to the operation of every diesel running today. It is through tests on these engines that suitable diesel lube and fuel oils have been developed.

There are relatively few of these engines made and these are generally found only in laboratories of engine manufacturers, oil companies, independent research groups, colleges and military research organizations.

Two leading manufacturers of these diesel test engines in the U. S. are Waukesha and Caterpillar, both in the business for years. Waukesha's test engine is generally used for testing fuels, while Cat's engine is primarily for testing lube oils. Both are single cylinder, 4-cycle engines.

Waukesha Test Engine

Through Waukesha's test unit, the ignition delay of a sample fuel can be determined and a cetane rating given to this fuel. The longer the ignition delay periods, the lower the cetane rating of the fuel. Fuels with low cetane ratings generally give poor cold starting, rough or irregular firing at light loads and knocking due to fuel accumulation in the cylinder. Hence the importance of accurately determining the cetane value of a fuel.

The Waukesha Standard CFR-48 design test engine is used. It has a 3¼ by 4½-in. cylinder with a variable-compression, swirl-type combustion chamber. Compression ratio is varied by screwing an expansible plug in or out of the cylindrical combustion chamber.

This design automatically compensates for change in air density with change of compression ratio, since chamber length increases with reduction of compression ratio. Micrometer graduations on the plug adjusting screw indicate combustion chamber length. Compression ratio range is 7:1 to 28:1.

A cast iron, 5-ring, flat-top piston of heavy construction is used.

The cooling system is of the gravity-return, evaporative-type with surge chamber and condenser attached to the cylinder.

Bosch injection pump with adjustable advance coupling and Bosch pintle type injector are used. Three fuel supply tanks equipped with strainer, sight gauge and three-way selector valve are mounted on the unit. A graduated burette for measuring fuel flow rate is also furnished.

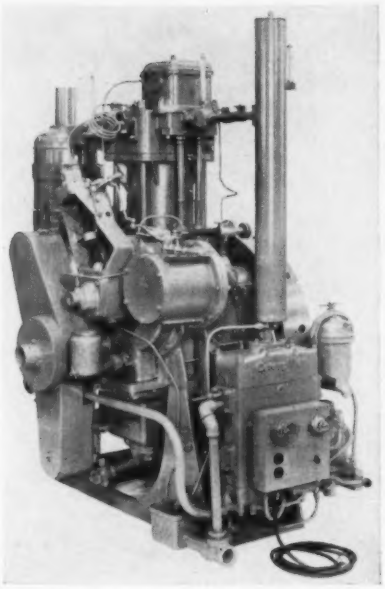
The intake pipe is equipped with electric heater for maintaining standard inlet air temperature.

For power absorption, a special synchronous induction 4-hp, 1200-rpm, 220-440-v, 60 cycle, 3-phase, motor is mounted on adjustable slide rails. It is driven by double-vee type pulleys from the 900-rpm engine.

A belt-driven 110-v, 220-w d-c generator on the motor frame provides current for the combustion and injection indicator neon lamps.

A bouncing pin-type combustion indicator with an electrical circuit lights a neon tube mounted on the flywheel. Sight tube, mirror, and fixed timing reference mark permit observation of the neon flash to indicate start of combustion.

A start-of-injection indicator on the injector body is arranged with a circuit to flash an indicating neon light on the flywheel as injection starts. The same mirror and sight tube as used for the combustion indicator is used to observe the start-of-injection indicator.



This Caterpillar single-cylinder test engine is used for testing and evaluating lubricating oils.

Caterpillar Test Engine

As to how the Caterpillar test engine came into being, shortly after their first diesel-powered tractors hit the field in 1933, reports of ring sticking and high internal wear rates began to trickle in. It was determined that either the lubricants were inadequate, or contained harmful ingredients. So it was decided to use the single-cylinder prototype of Cat's first diesel for testing these lubricants under actual operation. At that time (as at the present), there were no chemical or physical specifications available to determine if a certain lubricant would perform satisfactorily.

Based on Cat requirements and using the single-cylinder test engine as a tool, the petroleum industry developed the first group of additive oils for diesels. Specific testing procedures were developed by Caterpillar. To keep lube oils in step with engine development, the single-cylinder test engine has undergone changes from time to time. They are now available in three arrangements. Each serves a different purpose in the qualifications of advanced lube oils.

The basic engine arrangement is naturally aspirated with a 5¾-in. bore and 8-in. stroke. Included in the basic arrangement are the necessary engine accessories such as lube oil and water heat exchangers, oil and water temperature controls, temperature measuring equipment, etc. Lube oil tests are normally run at about 22 bhp at 1000 rpm for 480 hours.

Another arrangement adds a supercharger which permits testing at about 42 bhp at 1200 rpm. Same auxiliary equipment is used.

The third change-over arrangement is a high-speed test set-up permitting the basic unit to be converted to a 5⅛-in. bore x 6½-in. stroke engine to operate at approximately 42 bhp at 1800 rpm for 480 hours.

According to Cat, results of the test engine alone are not enough. Findings must be correlated with lubricant performance in field engines if the test engine is to be a valid tool. Oils developed in this manner have been applied satisfactorily to diesel engines operating in all conceivable services.

These test engines are not produced on a production line, but assembled and sold by Caterpillar's Research Dept. They are considered as a standard for test procedures. The oil industry has successfully applied the oils developed through use in these engines to many other types of engines, both diesel and spark ignition. Today such oils are recommended by many other engine manufacturers.

The oil industry and diesel engine manufacturers are equally interested in keeping pace with engine developments. The work of all makes of these one-cylinder test engines is another example of industries working together for the betterment of all concerned.

What Do You Know!

Here are some questions to test your general knowledge of the diesel field. Make your selections, then turn to Page 71 to check them.

1. The cetane number of a diesel fuel oil is determined by:
   a. Comparison with a reference fuel of known cetane value.
   b. Measuring ignition delay in milliseconds.
   c. By measuring knock intensity.

2. If a modern lube oil for use in highly-stressed engines is formulated to meet bearing lubrication needs, it will do all that is required.
   a. True b. False

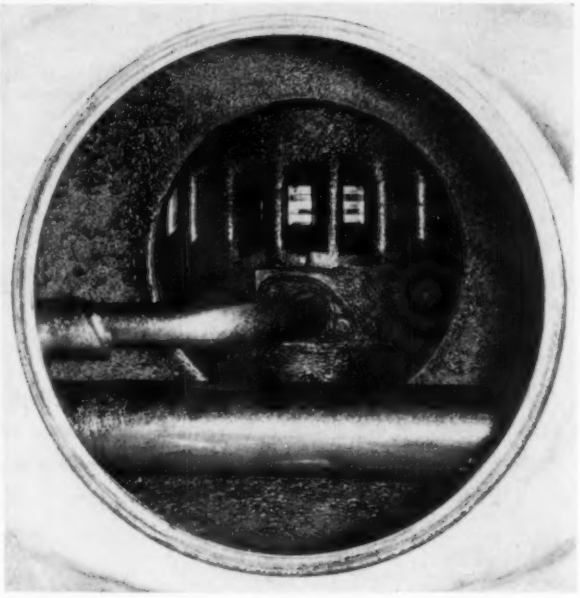
3. Investment cost per horsepower added by use of a turbocharger as compared to the cost per horsepower of the basic engine is about:
   a. 10-20%.
   b. 25-35%.
   c. 45-55%.

4. In 2-cycle engines scavenged by crankcase compression, the air charge will always be at less than atmospheric pressure:
   a. True b. False

5. The size of lube oil drops from a conventional liquid sight-feed lubricator are affected by which of the following:
   a. Leakage past the plunger.
   b. Type of liquid in the sight-feed.
   c. Lube oil viscosity.

What Makes A Modern Lube Oil?

Some ideas on how lube oils are tailored to meet the needs of today's high-output engines in severe services. Major oil characteristics are related to results in actual services.



Intake ports are clean and compression rings appear in excellent condition after using Gulf Dieselmotive 78 for about 165,000 miles.

GOOD lube oils just don't happen; not for today's high output engines. The higher temperatures, pressures and rubbing speeds all make it tougher on the oil. In fact, if it weren't for modern oil technology and the vastly improved lube oils that have resulted, it would be impossible to obtain today's standards of engine performance and service life.

Oils are "engineered" in much the same way that you would design an engine. You set up your objectives, select materials, integrate necessary components and when you get through, run evaluation tests. This means checking all the jobs that an oil must do.

There's more to it than just lubrication; oils must clean and they must cool as well. Furthermore, the oil must be suitable for all the varied jobs it must do in an engine. We tend to think in terms of bearing and cylinder lubrication but the whole valve mechanism, the gear trains and even piston cooling must also be considered.

When the petroleum engineers get through there is the final authority—the engine. You don't know what you have until you run full scale tests in actual service. Then the engine tells you how this works out in practice.

What We Need

We're going to need good lubricity—that quality of "oilness" that is so important for reducing friction. With this we need good inherent film strength since this will help determine how high unit loads can be without getting metal-to-metal contact.

Viscosity index, indicating the degree of viscosity change with temperature, should be well up in the range. This will have an effect on film thickness and adequate protection of rubbing parts must be provided at points where temperatures are highest.

Because of the high unit loads involved today (remember, not only the bearings and cylinders are lubricated but the valve and gear trains too) excellent film strength and oiliness properties are required in modern oils. The level must be sufficiently high to prevent scuffing and galling at the most critical points. Location of these spots will, of course, depend on engine design.

Then there is the matter of inherent stability and resistance to oxidation. Oxidation products are the cause of most harmful deposits. Also, in conjunction with by products of combustion, corrosive materials are formed. These oxidation products, with fuel soot and other solid contaminants, should he held in suspension. This brings up the need for detergency and dispersancy.

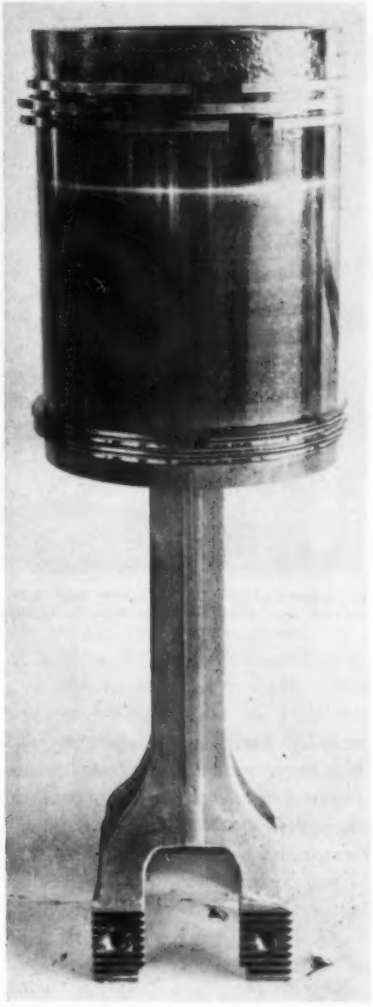
The detergency or solvent cleaning action of the oil must be adequate to keep engine parts clean. And so that contaminants are not deposited in various parts of the engine, dispersant additives must be present to hold the materials in suspension.

There are, of course, other factors such as volatility that affects oil loss at high temperature, antifoaming characteristics pour point, and even rust prevention. All of these must be considered in formulating an oil.

Formulation

Putting together an oil is something like baking a prize-winning cake. You start with all the ingredients, deciding which is best for the purpose, and then you put them to-

Valve stems show no significant lacquer or carbon deposit at point of valve guide travel limit after using new Gulf lube oil.



All rings are free on this piston and ring wear is at a minimum after operating about 165,000 miles. Under-crown deposits are negligible and piston skirt is free of substantial lacquer.

gether in the proper quantities and in the right way. The ingredients must be very carefully selected, not only for their own individual properties but for the combined effects that their properties produce.

Let's take a particular oil as an example—the new Gulf Dieselmotive 78. Since this was to be designed for high output service the very best stocks available were desired as a built-in safety factor. Emphasis was on balanced additive and base stock response with oxidation stability and anti-wear characteristics tailored for modern high output engine service.

But heavy-duty service requires fortification of natural qualities by use of additives. Natural detergency must be boosted by a detergent; dispersants are added; anti-oxidants used; etc. There are two big questions—how high should the total additive level be and what types and percentages of each additive should be used.

The first question must be answered on the basis of the service anticipated and knowledge of the requirements of such service. The second is a matter of petro-engineering. The organic compounds and metallo-organic compounds, must be compatible carefully balanced and have the proper response to the base stock to do the job.

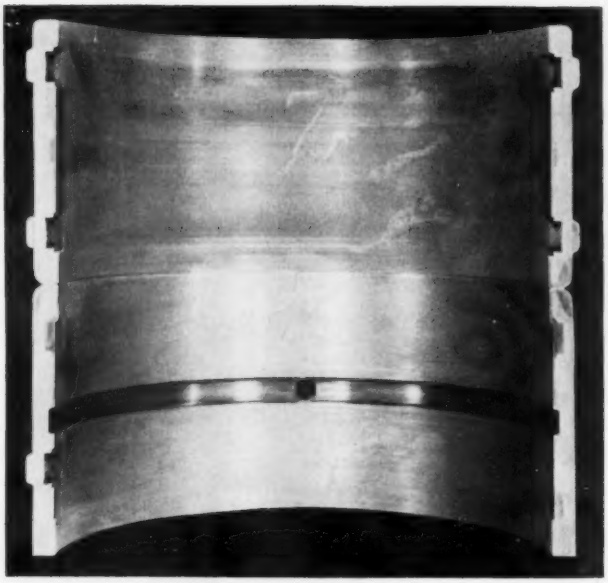
How all this is done is beyond the scope of this article but we can jump to the final step—service testing—to see what the results are if you do your job well.

Service Testing

The engine under service conditions is the first to tell you whether or not it likes an oil. The gentlest expressions are increased wear rates and deposits; the strongest, scoring, seizure and actual breakage. You can't look at one spot either; you have to look at different engine parts where the particular operating conditions make one or more of the oil's characteristics critical.

The pictures show parts of an EMD 567C engine in a locomotive unit of the Texas and New Orleans Railroad, a subsidiary of the Southern Pacific. These units were put through 330,000 test miles of rough freight hauling and at approximately 165,000 miles each unit was pulled down to see what the engine had to say. Let's try and correlate some of the objectives with actual results in the engine.

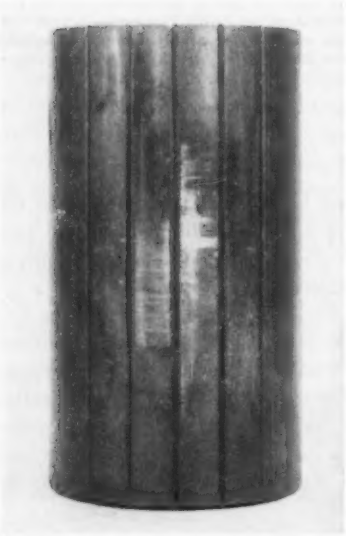
Adequacy of lubricity and film strength is indicated in several spots, certainly in the thrust washer and the bearings. The viscosity index is sufficiently high as to provide



Main bearings are free of lacquer and ready for further service even after long operation in locomotive diesel.

Thrust washer was also found in excellent condition after long operation. Wear was well below condemning limits.

sufficient film thickness and strength in the cylinder under high temperatures and pressures as evidenced by the low piston ring wear. The low wear rates that were found show the effectiveness of this group of qualities, both inherent and as fortified by additives.



Wrist pin bushing shows no corrosive etching at edge of silver plating adjacent to grooves and no scuffing on silver plating.

Combined effects of anti-oxidants, detergents and dispersants was to be seen in the general cleanliness of the engine. As illustrated here it is seen in the freeness of the piston rings (also indicating low volatility and good heat resistance) and the general freedom from lacquer and other deposits on the piston, valves and in the port area. Under-piston deposits were negligible.

Proper stability performance of the oil and its balance with the inhibitor can best be judged by engine cleanliness standards and used oil properties. However, this combination of inhibitor and oil must also provide proper lubrication of the high temperature silver plated piston pins without any evidence of scuffing, corrosion or etching of the silver plating.

Summary

All this would indicate that the oil was successful on its first real tryout. It was, but there's something to remember. Service trails are sort of a final exam; experience, lab tests, limited engine testing, etc., all go before. You should be pretty sure of the product at this point.

Now what does all this mean? It means that there is a built-in safety factor in modern lube oils. They are tailored to the conditions in today's engines—and have a little extra for tomorrow's engines or for a particularly severe service.

It also means a savings in maintenance dollars. In this particular test, many of the parts could be reused after inspection at 165,825 miles of tough service. It means a fuel saving because full power capability is maintained for longer periods. It also opens possibilities of extending service periods.

Training and Prestige—Goal of IH Program

Melrose Tech, IH's factory service training school, extends its impact right out into the field. Recognition of the technician's proficiency is awarded.

THIS industry has two big personnel problems. One is to get enough well-trained men, thoroughly familiar with factory know-how and methods, to keep the ever-expanding aggregate of diesel-powered equipment in shape. The second is to find how to give these highly skilled technicians the recognition that they deserve.

One manufacturer, International Harvester, being fully aware of both problems has set out to kill both birds with one stone. First, the company has set up a program of training on their various products that reaches right out to the grassroots. Secondly, they have set up machinery to grade technicians in accordance wtih their experience and ability.

Tying both together you get the concept of a technical institute. The curriculum is carefully worked out in courses specific to the need. Students are given instruction, pass examinations, and records are kept of their progress and accomplishment. Then a form of "Degree" is awarded in recognition of their achievement.

In fact it is a technical institute; it's Melrose Tech. This is what IH calls their school, headquarters are at the Melrose Park, Ill., plant.

Spreading the Light

How many men can you train at one school? Obviously, not enough. For the whole program to work, training has to be broadly decentralized. Then you have to find some way to insure that the instruction does not become diluted as it spreads out. Let's see how this was done.

Courses are prepared for mechanics by mechanics. Instructors at Melrose Tech are skilled technicians who not only instruct but prepare the instructional material and training aids. Students also assist in the preparation of training materials and are required to attain some proficiency in teaching.

This ability to both do and teach, with the instructional material as a "bible", makes the students able to give competent instruction in the field. This, plus the ready availability of the school-prepared training material, is the basis for spreading the light, undiffused, right down to the grassroots.

Instruction in the Field

Training is thus made available to any number of technicians at once and right on their home ground. Classes can be held in the shops of the distributors, dealers or users of IH equipment. Training aids identical to those used at Melrose Tech can be obtained at nominal cost. These include motion picture strips, slides, manuals, instruction sheets, etc. The only material furnished from local sources is the necessary IH equipment.

One reason why this type of program has proven so successful is that the subjects covered can be selected and presented at any convenient time. It also enables dealers to invite prospective customers and make them familiar with IH equipment.

Depending on the individual's experience and number and type of courses satisfactorily completed, three ratings are available—Technician Second and First Class and Master Technician. These awards, consisting of a distinctive lapel pin and diploma, help to promote interest in the training classes and give the men a definite and exclusive goal.

To qualify for Service Technician No. 2 you must have: two years experience on IH construction equipment. A minimum of 15 courses (five must be required subjects) plus a final exam must be completed satisfactorily.

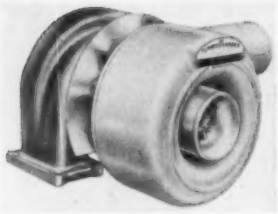
To qualify for Service Technician No. 1, four years experience on IH construction equipment is necessary, including one year of field experience or equivalent. At least 30 courses must be completed, 10 of which must be required subjects. You must also present, assist in preparation of, or organize a minimum of 5 training courses and take a final exam.

To get a Master Technician award, a mechanic must have eight years continuous experience on IH construction equipment including three years field experience or equivalent and shop administration for two years. Fifty of the available 59 courses must be completed, 15 must be required subjects. Attendance at Melrose Tech for at least one course since receiving his Technician No. 1 rating is required. In addition he must have presented and/or assisted in presentation and/or organization of 25 training courses. And finally he must complete satisfactorily the final exam at Melrose Tech.

Melrose Tech Training Facilities

Melrose Tech has a large shop area. It also features a classroom for tear-down and photographic purposes; a classroom specifically designed for fuel injection, electrical and hydraulic pump classes; a special tool room; a photographic laboratory used to edit, sound and prepare movies and slide films; and a large auditorium.

Most men want to learn. All they need is an opportunity. The proof is that some even go to Melrose Tech on their vacation at their own expense. They recognize the dual benefits received upon earning the IH awards—upgrading and recognition.



Schwitzer's new 4-in. air-cooled model turbocharger can have turbine and compressor inlet and outlet flanges set in any position for convenient mounting.

Field experience and continuous engineering development have resulted in Schwitzer's . . . .

New Turbocharger Models

TURBOCHARGING is a cheap way to get power. Investment cost per horsepower added by a turbocharger is about ¼ to 1/3 the cost per horsepower of the basic engine. Secondly, turbocharged engines deliver more horsepower per fuel dollar than unsupercharged engines. Small wonder then, that boosting output by turbocharging both field engines and new ones is so attractive.

Actually the savings don't end here—especially for new equipment. Vehicles cost less since a lighter chassis can be used. Greater pay loads at higher speeds are possible on trucks and earthmoving equipment.

Compact, light-weight turbochargers such as those made by the Schwitzer Corp., among others, permit simplified mounting, usually directly on the exhaust manifold within existing space limitations. This organization, for example, makes many models based on four sizes of turbochargers which are adaptable, in single or multiple units, to engines from 50 to 1400 hp.

Turbine and compressor inlet and outlet flanges on these units may be set to any one of several positions permitting mounting in the most compact manner. Unlike mechanically-driven superchargers, no costly gear trains, couplings and special mountings are required.

The charging pressure of these units is from 2-3 atmospheres and the weights and air capacities of the four wheel diameters are as follows:

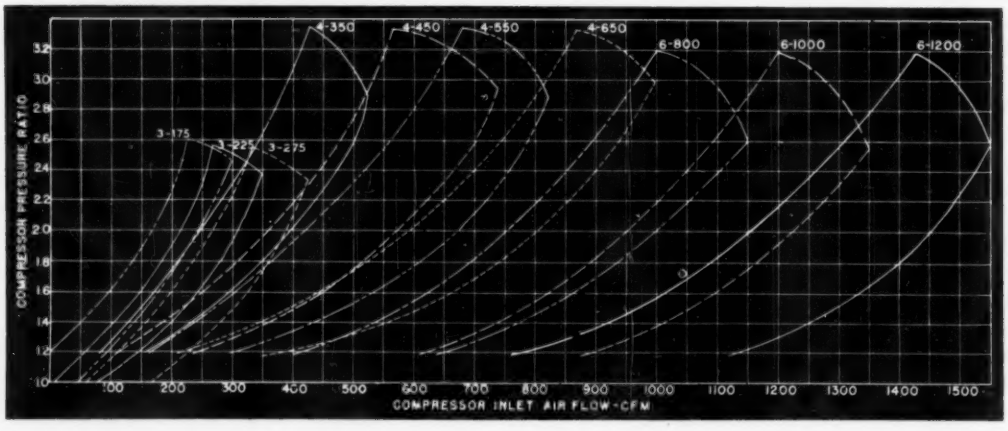
Turbine Wheel Size	*Approx. Air Delivery*	*Weight*
3-in.	150-300 cu ft	20 lb
4-in.	300-500 cu ft	28 lb
5-in.	250-500 cu ft	40 lb
6-in.	600-1200 cu ft	55 lb

The water-cooled 5-in. unit is Schwitzer's old work horse. But after years of reliable service it is still going strong. The 3-, 4-, and 6-in. turbos are new units. These air-cooled units round out Schwitzer's line of turbochargers. The air-cooled design eliminates all cooling water connections from the engine and gives greater simplicity, a most desirable feature. The only piping to the engine now consists of two oil lines for lubrication of the bearing and shaft assembly.

These turbochargers can be adapted to a wide variety of engines without change in basic design. Interchangeable stainless steel turbine nozzle rings are available to match operating conditions of each specific application.

Divided housings and nozzles are designed so that the turbine can operate as a blow-down or a steady-flow type. Generally, better results are obtained with the blow-down principle. This involves dividing the exhaust manifold so that there is no overlap of the cylinder exhaust processes discharging into any one branch of the manifold. The divided manifold and turbine housing makes better use of the exhaust gas energy. Lower average exhaust manifold pressures and better cylinder scavenging result.

Curves show compressor inlet air flow cfm at different pressure ratios for 3-, 4-, and 6-in. model air-cooled turbos.



Radiation shield between turbocharger at right and compressor at left helps to keep heat from air-cooled turbo away from air in compressor.

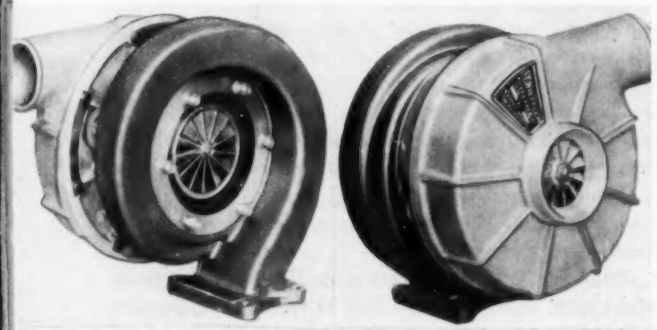
Efficiences are constantly being raised and turbine speeds are being increased beyond those believed practical only a short time ago. Also, significant results are being obtained with after coolers which reduce air temperature leaving the turbocharger and permit better performance over a wider range. Use of the after cooler is encouraged wherever possible.

The turbine housing is a Ni-Resist casting capable of withstanding high temperatures without scaling or stress failures. The bearing housing is grey cast iron while the compressor housing and cover are aluminum. Present recommended exhaust gas temperature limit is 1500°F.

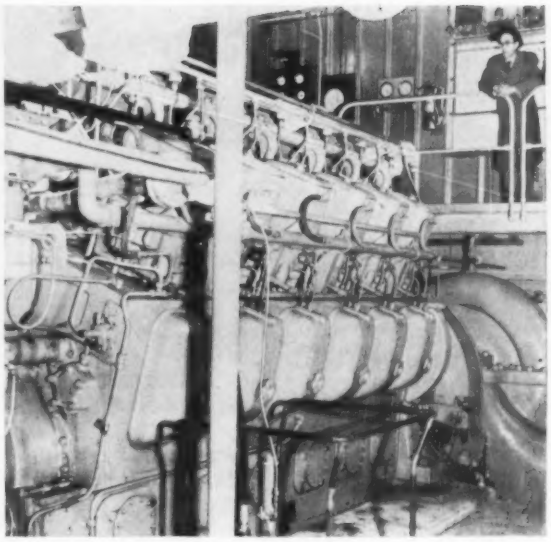
The bearing is of the sleeve-type, lubricated by engine oil. A double piston ring-type oil seal at each end of the shaft is pressurized by an air bleed from the compressor to seal leakage. End thrust at the compressor end of the shaft is relatively light. The compressor and turbine wheels are designed so that the thrust between them is balanced.

Design configuration of the cobalt-base alloy turbine wheel combined with the aluminum compressor wheel results in low inertia and low stress. Only a fraction of a second is required for the turbo to reach approximate full speed when a load is suddenly applied to the engines.

Advantages incorporated in their light weight result in ease of installation and quick acceleration. These units are designed for long reliable service and require only the normal maintenance given other parts of the engine.



Water connections for Schwitzer's older model 5-in. water-cooled turbocharger can be seen between the turbo and compressor on either view of this unit.



Dual-Fuel Engine Solves Industrial Load Problem

ALCO's first dual-fuel 12-cyl model 251 diesel has been placed in service by the Lukens Steel Co. This vee-type 1800-hp unit modified for dual-fuel operation, is rated 1380 hp at 900 rpm.

Lukens Steel uses the engine to pump water, to reduce peak loads on its electrical supply system and as a standby when servicing its electrical pumps.

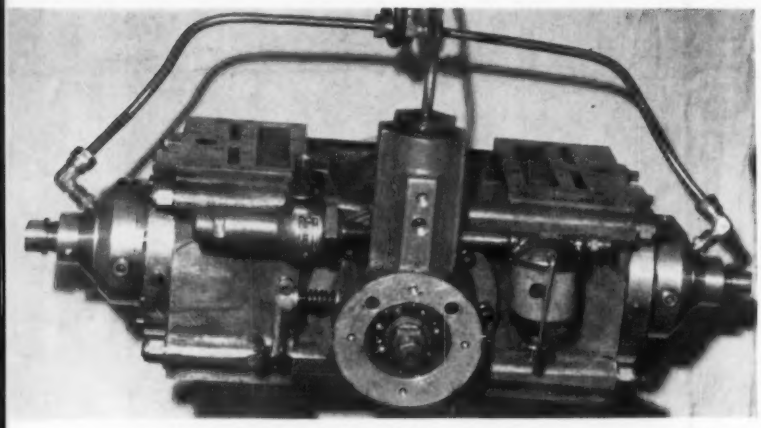
In pumping service, the engine powers a 20,000-gpm pump drawing water from a plant reservoir to the steel mills' furnaces. The engine operates about three days a week.

It is started with diesel oil, but once it reaches running temperature 92.5% of its fuel is natural gas. This dual-fuel operation provides a significant saving in fuel costs in areas where natural gas is purchased economically.

To accommodate the engine and pumping equipment, Lukens erected an inexpensive galvanized steel building with a comparatively light foundation for the engine.

The installation marks the second dual-fuel application of a 251 engine. A 16-cyl unit was installed at a pipeline-pumping station in the Midwest.

The 12- and 16-cyl engines, with a companion, in-line 6-cyl model, were introduced last year. They found application in a variety of stationary and marine installations. They also power all of Alco's current production of diesel-electric locomotives.



Basic engine, less manifolding, showing tie-rod construction. Injection pump outlet is siamesed to nozzles in heads, removable by unscrewing plugs. Mist lubricator is at left of injection pump above the throttle.

Unique Engine Tested

Engine's low weight-to-power ratio is based on low bmep, very high-speed, 2-cycle operation. Inventor claims that startling performance quoted depends principally on application of new combustion concepts.

WHETHER engines or the new cars, unusual designs take some "getting used to". And this light-weight, *really* high-speed diesel is certainly unusual. Its quoted performance data, particularly in view of its size, is startling.

Seeing the engine, you are impressed with its mechanical simplicity. It also gives evidence of cold, hard practicality, along with ingenuity, in the way that proven mechanical principles have been applied to produce an unusual design. It appears to be an inexpensive engine to produce. This also applies to the injection system, the cost bugaboo of all small diesels.

Mechanical excellence, however, could not account for the performance claims made by the inventor, Max C. Fiedler. He has an extensive background, gained both here and abroad, in internal combustion engine design. Of special importance, his work in the field of fuels and combustion systems for everything from rockets to diesels, lead to the development of the combustion principle upon which performance success of the design depends.

Engine Features

The engine is described as a multi-fuel compression-ignition engine. It is reported that any injectable hydrocarbon can be burned with No. 2 heating oil preferred. For reasons of balance at high rpm, the "Lanchester" system in which reciprocating motion is in balance at all times was selected.

This involves two pistons, horizontally opposed, connected to the crankshaft by one straight rod and a "U"-shaped stirrup rod. Both cylinders fire simultaneously on the 2-stroke cycle. Bore and stroke are 3½-in. by 2-in. giving a displacement of 38½ cu. in. Compression ratio is 23 to 1, figuring effective stroke. Basic engine weight is 75 lb.

Now hold tight. Mr. Fiedler rates the engine at 50 hp turning 8000 rpm. Before you shy away from this speed, remember the 2-in. stroke; it figures out to a 2700-fpm piston speed. Weight-to-horsepower ratio is 1.25 to 1.

Mr. Fiedler puts the fuel consumption to 0.3 lb per bhp hr with excellent part-load efficiency. He credits this phenomenally low fuel consumption to (1) his combustion system and (2) low friction and minimized parasitic loads. Item 1 will be discussed later.

As to Item 2, anti-friction bearings, both ball and roller, are used practically throughout. Two-cycle operation eliminates all valve gear. There's no lube oil pump as a small part of the fuel is fed into the intake air to mist-lubricate all moving parts.

No radiator or water circulating pump are used. Heat rejection to the water is low, in line with quoted fuel consumption, and heat convection from the aluminum cylinder blocks is said to be adequate.

Construction

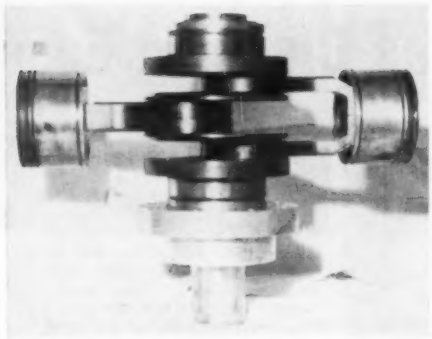
Each cylinder block is an aluminum casting. Shrunk-in, ported cast iron liners are used. These are bored and ground to size. Two mated blocks enclose the crankshaft, eliminating the usual crankcase. They are tied together by alloy steel through-bolts that are stressed to carry cylinder pressures and keep heads and blocks in compression.

The cylinder heads are aluminum forgings, symmetrical about a center line. Size of each combustion chamber is 0.7 cu in.

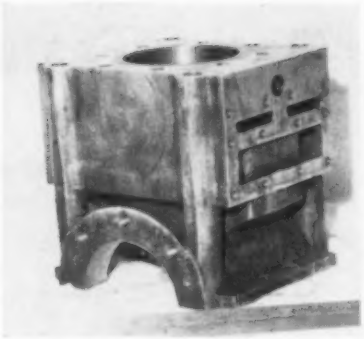
The crankshaft is of alloy steel, heat treated. The shaft and reciprocating elements are inherently in balance without counterweights. The shaft itself is dynamically balanced. Main bearings are deep-grooved ball bearings.

Connecting rods are alloy steel forgings, heat treated. Roller bearings are used at the crank end and needle bearings on the wrist pins.

Aluminum alloy pistons are used. They are flat topped, true round, with full skirts free of slots. Wrist pins are fastened by cap screws to the underside of the piston crown.



Rotating and reciprocating assembly of "Lanchester" is always in balance. Bearings are anti-friction type.



One of two aluminum blocks that mate to support and enclose crankshaft, eliminating the conventional-type crankcase.

Liner's top row of ports is for exhaust; middle row is for air intake from crankcase to cylinder; bottom row is for air intake to crankcase.

A fuel injection pump of the utmost simplicity is crank-driven. The nozzles are equally simple and can be removed without disturbing the fuel lines.

Combustion System

Performance of this engine is feasible only by strict adherence to certain principles of combustion expounded by Mr. Fiedler (see "New Theory of Combustion", Journal of the Franklin Institute, Vol. 233, Nos. 1 and 2, 1942). According to this concept, elimination of detonation requires that the injection period be so short that no reaction, with its accompanying temperature rise, takes place before all the fuel is introduced into the combustion air.

Practical injection durations range from 8 to 12-deg crank angle—8 deg being preferable. Fuel must be introduced during this short interval in liquid, widely-separated particles which must be placed in the air in such fashion that a stoichiometric ratio is established. Droplets should be large, otherwise high pressures are needed to make them penetrate the dense, highly-compressed air. Injection pressure should not exceed 1800 psi and duration should be constant for all quantities injected at all speeds.

Low-Cost Injection Equipment

You can see that these injection requirements are considerably different from those commonly accepted. They permitted Mr. Fiedler a whole new approach to the design of injection equipment. An extremely simple pump with equally simple control was built and under test was found capable of producing the desired characteristics at frequencies up to 12,000 per min. It is estimated that in reasonable quantity it can be produced at a cost approximating that of a gasoline engine distributor head.

The nozzle valve must also conform to the required characteristics. To produce the necessary spray, its functions are radically different from present-day valves that depend on a fixed orifice. This gives a different spray characteristic for the same fuel quantity at different speeds or gives different spray characteristics with varying quantities at constant speed. Fiedler's design provides for a "flexible" orifice concept, while the fixed orifice is of such a size that it never offers a fuel restriction. The only function of this orifice is to form a suitable spray pattern.

Again, Mr. Fiedler's practical streak is in evidence. Realizing the importance of cost, he used a new approach in selection of materials and manufacturing methods. All lapping processes are eliminated. The result is a nozzle that can be sold at a price competitive with a spark plug.

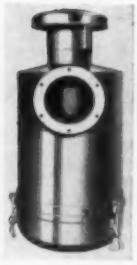
Operation

The high output of this engine depends on high-speed operation at a low bmep. There is a definite school of thought favoring this type of 2-cycle operation. Evidence is seen in some foreign engines and at least one other under development in this country.

With low bmep's, the approach to scavenging can be entirely different. Note the porting on the liner shown. There need not be the emphasis on low breathing restriction and complete removal of residual gases. The air required per firing, in view of the modest amount of fuel injected, is low and some heat of residual gases can be retained for future work. This helps on the fuel bill.

This engine is crankcase-scavenged. Design of the porting is such that crankcase compression provides a supercharge of about 8 psi at full speed. Maximum cylinder pressures are about 1000 psi.

The low weight-to-power ratio of such an engine would make practical a great many applications where more conventional diesels cannot be considered. This would apply even at fuel consumption rates currently accepted for engines in this horsepower range. All this, plus the promise of low original cost, presents interesting possibilities for this engine design—should it get to the production stage. Several have been built and extensively tested. And Mr. Fiedler says that there is no reason why horsepower in multiples of the basic unit could not be obtained by adding more pairs of cylinders.



Air Filter Design Features Cleaning Ease

Make it easy to clean and chances are it will get serviced more regularly to maintain top efficiency.

NO matter how well an air filter is designed, its long-term efficiency depends on servicing. Ease and speed of cleaning offer the best chance that design efficiency will be realized. The United Specialties Co. had this definitely in mind when they developed their new Remov-All Series "999" line of oil bath air cleaners.

The Series "999" includes models ranging from 260 to 1600 cfm capacity. Yet even the largest model can be installed and serviced by one man in a very short time.

These recently introduced units, with removable elements and removable after cleaner are said to have high dirt-removal efficiency and excellent dirt-holding capacity.

The oil bath sections are combined in a single unit with a fibrous after cleaner which does not need replacing. Once the cleaner housing is installed on the engine it is not necessary to break the connections to service the cleaner.

The after cleaner, or top element, has been thoroughly field tested at temperatures from minus 65°F to 145°F. The material is structurally strong to withstand any operating shock and will not fracture under air load stock. Sealing is positive in all directions and against all flanges.

Design of the unit is such that only proper reinstallation of parts is possible. Both the middle and bottom sections, which are not identical in structure to insure correct installation, have filter elements composed of wire springs. These springs are positive meshing and non-collapsing, and provide positive oil-wash action without channeling.

Bracketed studs on the center tube and large wing nuts located on brackets in the element centers permit easy hand-assembly. When servicing of only the lower element is necessary it is easily removed and quickly washed since only one wing nut has to be unfastened.

Easy servicing extends also to the oil cup cleaning. The inner baffle (which incorporates United's well-known 'dirty-clean' oil separation and 'bounce-splash' control) can be removed by a wing nut jack screw. This nut, as well as all other wing nuts, is permanently fastened to the specific piece. After the baffle is removed the cup is easily cleaned. The cup could be filled with solvent and used for cleaning all elements.

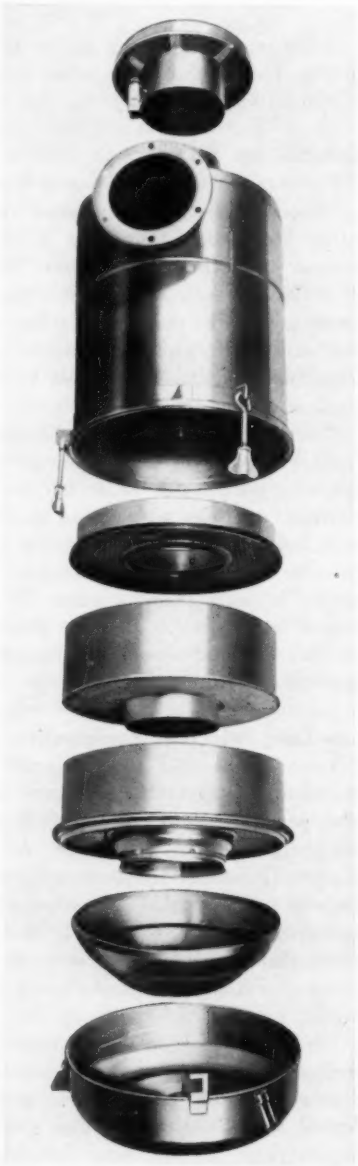
Unitizing of the assembled elements is accomplished as the three cup holders are drawn tight. These three holders, spaced 120 deg apart on a rotating band on the cleaner body, definitely position and seal the cup. When the cup is replaced it is initially suspended upon the two hooks which are rotated to the handiest installation location.

Removal of the cup and all parts is accomplished with a clearance space of 2½-in. below the cup. This space is usually necessary under any standard oil bath cleaner cup.

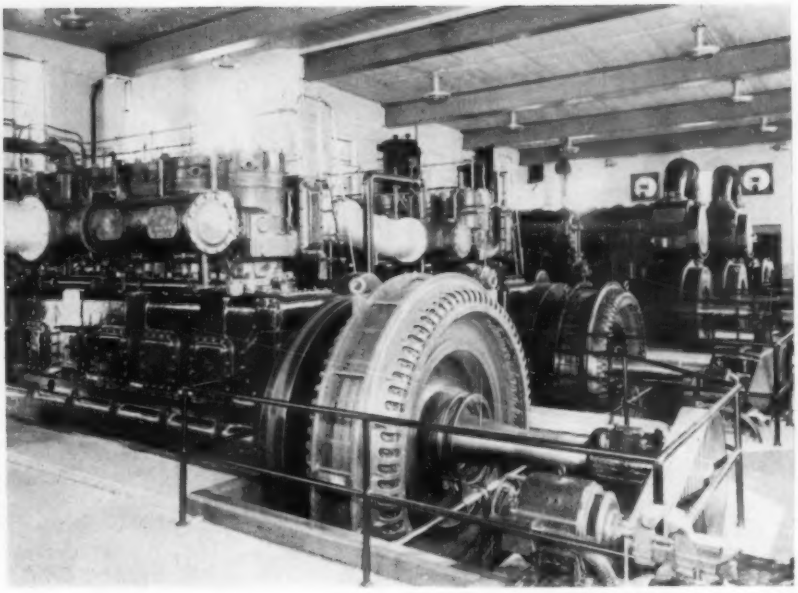
The Series "999" cleaner has been developed in accordance with the air cleaner SAE code. It has been tested under extra heavy dust conditions and approved by leading engine manufacturers.

Its low restriction and steady efficiency allow it to be used as a standard on a wide range of manufacturers' equipment.

Oil bath sections are combined in a single unit with a permanent-type fibrous after cleaner. All elements including the after cleaner are easily removed and cleaned.



The 17 year old Seaford, Del., municipal power plant located on the Nanticoke River houses five Fairbanks-Morse diesel generator sets. Vertical 150,000-gal cylindrical fuel oil steel storage tank is seen in background at upper right.



From left to right you can see the 1200-hp Model 33F16, 875-hp Model 33D16, 1600-hp OP, 1920-hp OP and 300-hp diesel unit.

Profits Today and Tomorrow Too

One measure of current operational efficiency is the extent of planning for the future. Here, a municipal plant rates high.

SEAFORD, Del., planned ahead. It insured ample funds for past and future expansion and improvement of its municipal power plant. When the plant went into operation in 1937 with three 300-hp Fairbanks-Morse diesel generator sets, profits were intended for civic improvement.

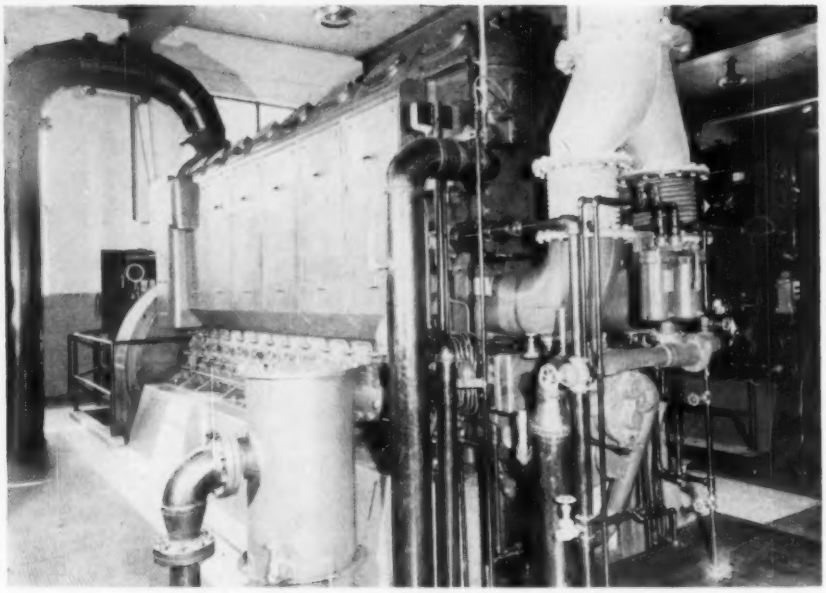
In the past four years alone, the plant has given the City $232,000 for expansion and improvement of the water and sewage disposal systems, and for purchase of a fire truck. Too often, however, municipal power plants are milked dry. But Seaford knew better than to bleed the source of these blessings. Their charter specifically states that 25% of gross plant receipts are to be used solely for erection of a new plant, or expansion, rebuilding, and improvement of the existing one. Only when this reserve fund reaches $200,000 does it become unnecessary to add to it. A similar provision set up a $100,000 fund for the electric distribution system.

With these mandates in the charter the plant is always in a position to buy the equipment it needs to do its job well. Despite the addition of a 1600-hp unit in March, 1951 and a 1920-hp diesel in September, 1954, both F-M, opposed-piston engines, the plant is free of debt. At the start of the current fiscal year, $316,350 was in the reserve funds.

At the end of fiscal year 1940, the plant had a net profit (*after* depreciation) of $29,187. By 1945, the profit was up to $43,144; in 1950, it reached $71,905; and in fiscal 1956 reached $101,981. In 17 years the plant earned $1,093,363. This net profit is calculated after deduction of all costs of production and distribution including reserve for depreciation.

Background

In 1939, two years after the 300-hp units went into operation, the building was expanded and an 875-hp, F-M Model 33D16 was installed. Enough space was left for still another unit. This space was filled in 1947 by a



Largest and newest of the two OP diesels is in foreground. Each OP is compact enough so that the space occupied by an original 300-hp unit was sufficient for the installation. Air intake pipe is seen leading into blower at rear of engine. Auxiliaries and piping are arranged so that they don't interfere with the engine servicing.

1200-hp Model 33F16 F-M diesel. Total plant horsepower was now 2975. Since then, the plant has nearly doubled its capacity without enlarging the engine room.

A 1600-hp Model 38D8-⅛ F-M OP was placed on the spot previously occupied by one of the original 300-hp units in March, 1951. In Sept., 1954, a 1920-hp unit set up shop in the space vacated by another 300-hp diesel set. This increased plant capacity over 98% to 5895-hp. There is still room for another OP in the space occupied by the last of the 300-hp units.

Plant Operation

The two OPs fit neatly into the plant's operating pattern. They serve as the base load units. But every engine in the plant is called on to serve every day except Sunday. The 1920-hp diesel generally runs from 7 am to midnight with the 1200- and 300-hp units helping as needed. If the load is higher, the 875-hp unit replaces the 300-hp engine. About midnight, the 1600-hp unit takes over the base load with help as needed from the 1200-, 875-, or 300-hp engines.

A total of 6,098,100 kwh were produced during the fiscal year ending in 1952, with the 1600-hp OP in service only part of the time. In the year ended January 31, 1956, the 1600-hp unit generated 3,188,000 kwh and the 1920-hp engine, 4,300,900 kwh, two-thirds of the plant total of 11,199,000 kwh.

Peak load hit 2880 kw last Winter and will probably equal to or top that level this Summer. Balancing of Summer and Winter loads has been a healthy development at Seaford . . . Combination of three power-consuming feed mills and the growing use of air conditioners has built up summer load and provided more efficient use of plant capacity.

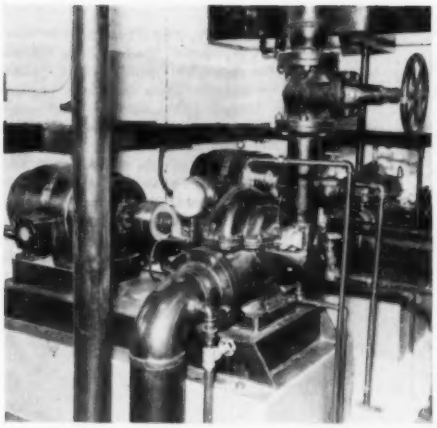
However, the mill load is not without its problems. The largest of the mills pulls 500 kw and comes on and off the line without warning. Therefore the plant has to keep enough reserve capacity on the line to handle the load when it hits. Naturally, this cuts operating engine load factor with some loss of efficiency. In spite of this, the OPs give good fuel economy. For example, up to the start of the current fiscal year, the big engine produced 5,491,900 kwh while consuming 415,330 gal of fuel, an average of 13.22 kwh per gallon.

This community in central Delaware is out of reach of the natural gas pipelines and has to subsist on the more expensive fuel oil. Fortunately, the plant is located on the Nanticoke River and can receive fuel by barge. Installation of a 150,000-gal vertical, cylindrical steel storage tank permits buying fuel in 125,000-gal barge loads. This saved enough on fuel costs in a single year to pay for the tank.

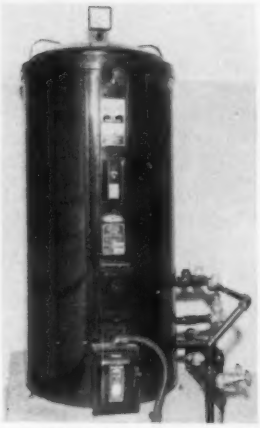
From this tank, fuel flows by gravity to 15,000-gal and 25,000-gal horizontal storage tanks. Then it is transferred by automatically-controlled pumps to the individual engine day tanks.

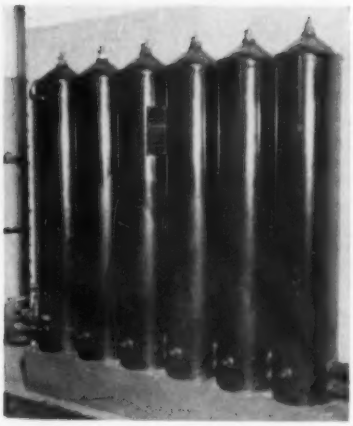
Location on the river also eliminates the need for cooling towers. Each diesel has a separate closed cooling system with a motor-driven centrifugal pump sending water through the engine jackets and a heat exchanger. A second motor-driven centrifugal pump takes cold water from the river and pumps it through the heat exchanger and the oil cooler.

The detergent-type lube oil used is checked regularly



Each diesel has a separate closed-cooling system with one motor-driven centrifugal pump for the jacket water and one for pumping raw river water.





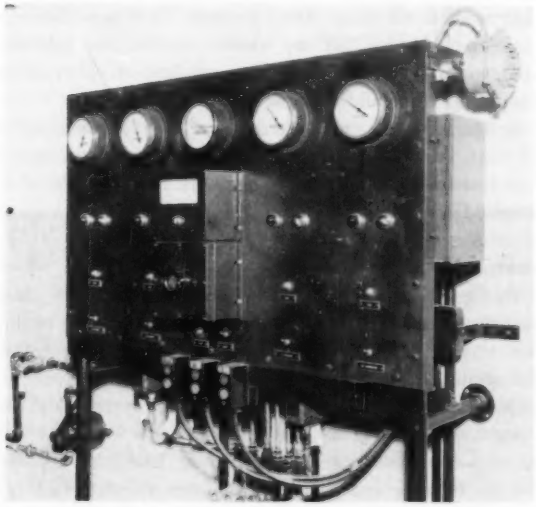
Honan-Crane lube oil purifier with heater, at left, serves all engines In addition, full-flow strainers and cartridge-type bypass filters are used. Filters shown at right serve the two opposed-piston diesels.

and kept in good condition. Each OP has a full-flow strainer and a cartridge-type bypass filter with cellulose-packed elements. In addition, the plant is equipped with a purifier that has a heater, filtration element and motor-driven pump.

After an overhaul, or whenever oil is contaminated, it is drawn from the engine base, filtered and either returned to the engine or sent to a storage tank. Lab analysis of oil is made every 1000 hours.

Seaford believes in preventive maintenance and the engines are inspected carefully every 500 hours. The 1600-hp OP got its first overhaul after 9265 hours of operation. Chief engineer Chester Willen reported that pistons, liners and bearings were all in excellent condition. There was almost no liner wear and the wear on the aluminum bearings was so slight that it could not be measured. In preparation for a Summer of heavy service, the 1920-hp engine was overhauled in March 1956 at 6122 hours. Again Mr. Willen reported excellent condition and negligible wear.

Guage panel is equipped with a lube oil pressure guage and jacket water temperature guage for each OP engine, exhaust pyrometer seen at lower center and alarm at upper right.



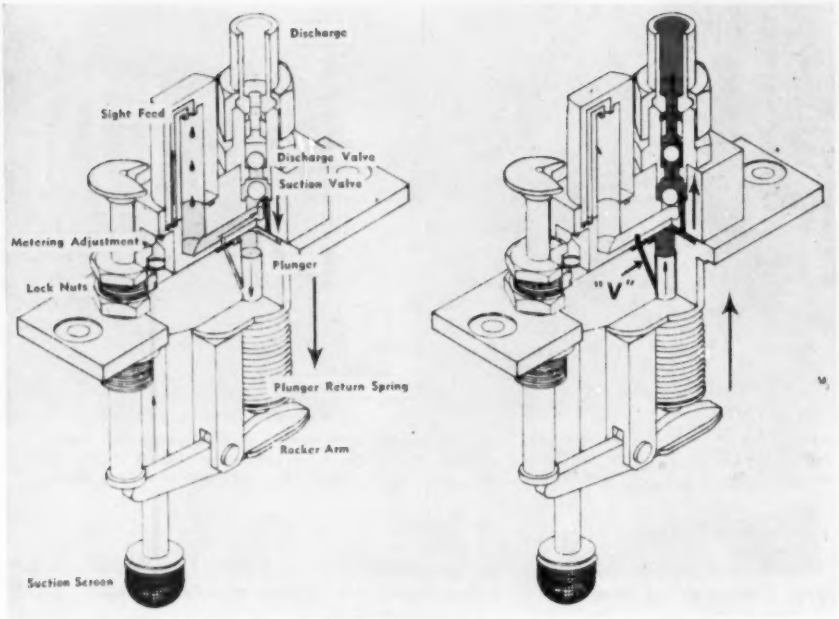
Conclusion

The municipal utility is managed by Woodrow W. Crosby who also serves as City Manager. Mr. Crosby served at the power plant before moving to the administrative post. All operations are under the policy supervision of Mayor Randall A. Larrimore and Councilmen Hitchens, Culver, Lank, Marvel and Kindell.

Seaford calls its municipal utility the Seaford Light and Power Company. This makes it sound like a business enterprise—and it is appropriate, for certainly this plant has been good business for the city.

Principal Equipment

Diesel Engines	Fairbanks, Morse & Co. (1) 1920-hp and (1) 1600-hp Model 38D8-1/8, 720 rpm.
Alternators	Fairbanks, Morse & Co.
Governors	Woodward Governor Co.
Lube oil	Pure Oil Co.
Lube strainer	Air-Maze Corp.
Lube filter	Fairbanks, Morse & Co.
Lube purifier	Honan-Crane (Houdaille-Hershey)
Lube cooler	Schutte & Koerting Corp.
Fuel oil	Shell Oil Co. Cities Service Oil Co.
Fuel filters	Wm. W. Nugent & Co., Inc.
Fuel meters	Buffalo Niagara Corp.
Cooling water pumps	Fairbanks, Morse & Co.
Heat Exchangers	Schutte & Koerting Corp.
Air filters	American Air Filter Co.
Intake silencers	Maxim Silencer Co.
Exhaust silencers	Maxim Silencer Co.
Starting air compressors	Fairbanks, Morse & Co.
Gauge panel	Weaks Engineering Co.
Exhaust pyrometer	Alnor (Illinois Testing Labs., Inc.)
Gauges	Duro Instrument Co.
Switchboard	Marquette Electric Switch-Board Co.
Switchboard Instruments	Westinghouse Electric Corp.



At left, (Fig. 1), plunger is moving down and oil is drawn through screen, sight glass, suction valve and into plunger bore by means of two small ducts that straddle suction valve seat. At right, (Fig. 2), plunger is moving up, suction valve is seated, and oil is forced through two small ducts and past discharge valve. Leakage past plunger is drawn back into sight feed by vacuum through the passage labeled with "V".

How Big Is A Drop?

New lubricator's metering principle and system for setting compensates for variables affecting lube oil drop size, correlating drops to specific volume.

HOW many drops in a pint of oil? Engine manufacturers often specify that a part should be lubricated by a definite amount of oil, for example, say a pint per 24 hr period. On the other hand a lubricator is set to meter a specific number of drops per minute because it's more convenient. But, how large is a drop? Is the drop size always the same? Naturally the drop size will control how many of them there are in the pint of the required oil.

Many variables affect drop size and therefore metering when the lubrication is set on the basis of drops per minute. Such factors as oil viscosity, the type of liquid in sight feeds, plunger slippage, and orifice diameter and condition, all affect drop size. For example, heavy oils form larger drops and fewer per pint than light oils. The density of liquid used in conventional sight feeds will vary the size of drops. Plunger leakage or slippage is bound to occur at high pressure.

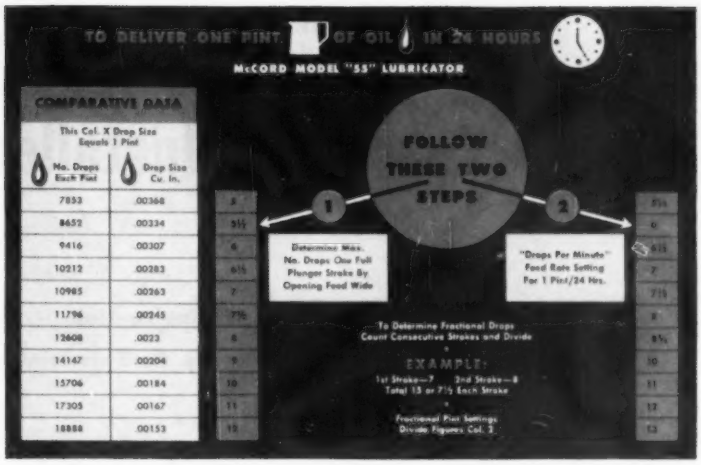
Recognizing the convenience of setting by counting drops and also the inaccuracies resulting from the variables, McCord Corp. engineers produced a lubricator design that retains the convenience while minimizing the inaccuracies of drop measurement. This was done in their new Model "55" by modification of the metering and pumping assembly plus a method of correlating drops and a specific volume of oil.

Settings for a given amount of oil over a given period of time are simple and in no way involve lubricator speed or oil viscosity. All guess work is said to be eliminated. Here's how it works.

Lubricator Operation

In Fig 1, oil is being drawn through the sight glass, past the suction valve, and into the plunger bore through two small ducts that straddle the suction valve seat as the spring moves the plunger down. As cam lift on the rocker arm moves the plunger on the upward or discharge stroke, (Fig 2), the suction valve is seated and oil is forced from the plunger bore back through the two small ducts and past the discharge valve.

Under comparative data, column at left gives number of drops of oil per pint when drop size is as given in adjacent column. Drop size is found by dividing number of drops per plunger stroke into plunger bore cu in displacement. Column 1 at left lists the number of drops per plunger stroke with feed wide open. Column 2 at right lists corresponding drops per minute feed rate setting to get 1 pint of oil in 24 hours.


TO DELIVER ONE PINT OF OIL IN 24 HOURS
McCORD MODEL "55" LUBRICATOR
COMPARATIVE DATA
This Col. X Drop Size Equals 1 Pint
No. Drops Each Pint
Drop Size Cu. In.
7853 .00368
8652 .00334
9416 .00307
10212 .00283
10985 .00263
11796 .00245
12608 .0023
14147 .00204
15706 .00184
17305 .00167
18888 .00153
FOLLOW THESE TWO STEPS
1
2
Determine Max. No. Drops One Full Plunger Stroke By Opening Feed Wide
"Drops Per Minute" Feed Rate Setting For 1 Pint/24 Hrs.
To Determine Fractional Drops Count Consecutive Strokes and Divide
EXAMPLE:
1st Stroke—7 2nd Stroke—8
Total 15 or 7½ Each Stroke
Fractional Part Settings Divide Figures Col. 2

High pressure feed back to the sight feed shown by the letter "V" shows how plunger wear is compensated. Any slippage is immediately drawn back into the sight feed glass by the vacuum in it. The amount of oil taken in on the next plunger stroke is automatically reduced by the amount of slippage. This positive feature makes it possible to obtain accuracy in lubricator feed setting.

In addition, with the sight feed on the suction side of the plunger, the liquid-type sight feed (which must be used when it is located on the discharge side of the plunger) is eliminated and with it, its maintenance problems.

Counting the Drops

The Model "55" lubricator gives controlled volume setting. It does not rely on internal porting. Its maximum plunger displacement (at any intermediate setting) is a fixed quantity and does not vary. Therefore, the number of drops of a certain viscosity oil will be uniformly the same.

With the plunger operating at maximum stroke, the drops for each plunger stroke can be counted and thereby the cubic content for each drop found. If this cubic content of each drop is divided into the number of cubic inches in a pint (28.9 cu in.), the number of drops per pint of oil is easily determined.

For example, the maximum plunger displacement for the Model "55" lubricator with a ¼-in. diameter plunger is 0.0184 cu in. Assuming that there are 7 drops in each plunger stroke, the cubic content of each drop of that particular oil must be 0.00263 cu in., (0.0184 divided by 7). Dividing 0.00263 into 28.9 (cu in. in a pint) gives 10,985 drops per pint.

As seen in Fig 3, if oil viscosity is such that the plunger gives 7 drops per stroke, your lubricator will deliver 10,985 drops or 1 pint of oil in 24 hours. Should oil viscosity be such that the plunger displaces 10 drops for the same length stroke, 15,706 drops or 1 pint of oil will also be delivered in 24 hours. For each setting given in column 2, Fig. 3, the corresponding number of drops shown at the left will constitute a pint.

To determine fractional drops, count the number of drops discharged on two consecutive strokes. For example, if 7 drops are obtained on the first stroke and 8 on the second, the total would be 15. Dividing this total by 2 gives 7½ drops average per stroke.

When testing for drop size the lubricator feed must discharge to the atmosphere. This is done by loosening the union connection on the pump discharge. The reason for this is that the lubricator is required to feed against a relatively high pressure of several thousand psi and some slippage takes place. A more accurate setting is obtained knowing the exact cubic content of the drop determined at atmosphere.

The above method works best when the lubricator camshaft speeds are held at about 8 rpm. Faster speeds tend to cause the oil to stream, making it difficult to count the drops as they fall off the nozzle. If the lubricator has a hand crank, drop size can be determined by hand cranking while the lubricator is standing idle.

In a lubricator having a multiple number of feeds, the amount of oil required to each point should be determined from the engine manufacturers recommendation. This can easily be broken down to drops per minute. For example, if you have a 10-feed lubricator with miscellaneous feed settings that total 30 drops per minute, this amounts to 1800 drops per hour or 43,200 drops in 24 hours.

If the drop size indicates that there are 15,700 drops in each pint of this particular oil, approximately 2¾ pints are used at this setting, (43,200 divided by 15,700). This means that every 24 hours our make-up oil is 2¾ pints and if the lubricator gauge glass is marked in pints, a cross-check on the feed accuracy of the above described setting can be made.

Is Your Drive Installed Correctly?

Improper installation of drive line components, particularly where U-Joints are concerned, can be very costly. Here are some ideas on correct procedures.

BEYOND outright misapplication of diesels and allied equipment, up to 90% of component failures may be caused by improper installation and maintenance.

This is particularly noticeable where universal joints are improperly installed between power take-offs and driven equipment such as irrigation pumps. Either the needle bearings of the universal joint itself, or the power take-off bearings may fail. In either case the failure may be extremely costly—costly far beyond the mere replacement of parts.

When making U-joint installations, it is essential that the drive shaft forks lie in the same plane between the power take-off and the driven equipment. This will prevent severe vibrations in the drive shaft.

Next, the centerlines of the PTO shaft and the driven equipment's input shaft *must* be offset within the limits recommended by the U-joint manufacturer. This prolongs U-joint needle bearings life.

The third important installation requirement is that the PTO shaft and the driven-equipment's input shaft centerlines be parallel. This also helps prevent vibrations that cause PTO bearing failures.

Installation Procedure

To insure that centerlines of the PTO shaft and the driven-equipment's input shaft are parallel use a tape measurer and two accurate straight-edges at least 36-in. long. Place the straight-edges horizontally along the face of the PTO and the driven-equipment's input shaft flange. See Figure 1.

Measure distances A and B as shown in Figure 1. A and B should be equal within one-eighth inch when measured 18-in. out from the centerlines of the shafts. If the difference in A to B is greater than one-eighth inch, move the engine to bring these distances within required limits.

Next rotate the straight-edges to the vertical position shown by dotted lines in Figure 1. Distance C should be equal to distance D within one-eighth inch when measured 18-in. from the center of the shafts. If C and D are greater than one-eighth inch, move the engine to bring these distances within required limits.

Repeat this procedure until distances A and B and C and D are equal to each other within one-eighth inch when measured 18-in. from shaft centers. When finished, securely anchor the engine. The PTO shaft and the driven-equipment's input shaft will now be parallel within one degree.

PTO Output Shaft Bearing Adjustment

Field experience with high-speed U-joint installations, particularly with irrigation pumps, indicates that extra care must be taken when adjusting the power take-off tapered roller bearings.

Power take-off output shaft end play should be held within limits specified by the PTO manufacturer. Figure 2 shows the method of checking this end play with a dial indicator. A step-by-step procedure for doing this is as follows:

1. Make sure that bearings do not contain grease.
2. Tighten bearing adjusting nut until bearings are free to rotate without noticeable drag or end play.
3. Back off adjusting nut 2 or 3 notches.
4. Strike shaft's output end with a soft hammer or block of wood to set bearing cup (outer race) against adjusting nut.
5. Place housing and assembly on firm blocking as shown in Figure 2.
6. Install dial indicator as shown in Figure 2.
7. Move shaft up and down and observe end play reading on dial indicator. The shaft may be moved by prying under the pilot end in a vertical direction or by lifting with a hoist and eye bolt installed in the rifle drill at the output end.
8. If the end play reading is below manufacturer's limits, back off adjusting nut and follow steps 3 through 6 until proper end play is obtained.
9. If the end play reading is above manufacturer's limits, tighten adjusting nut and follow step 3 through 6 until proper end play is obtained.

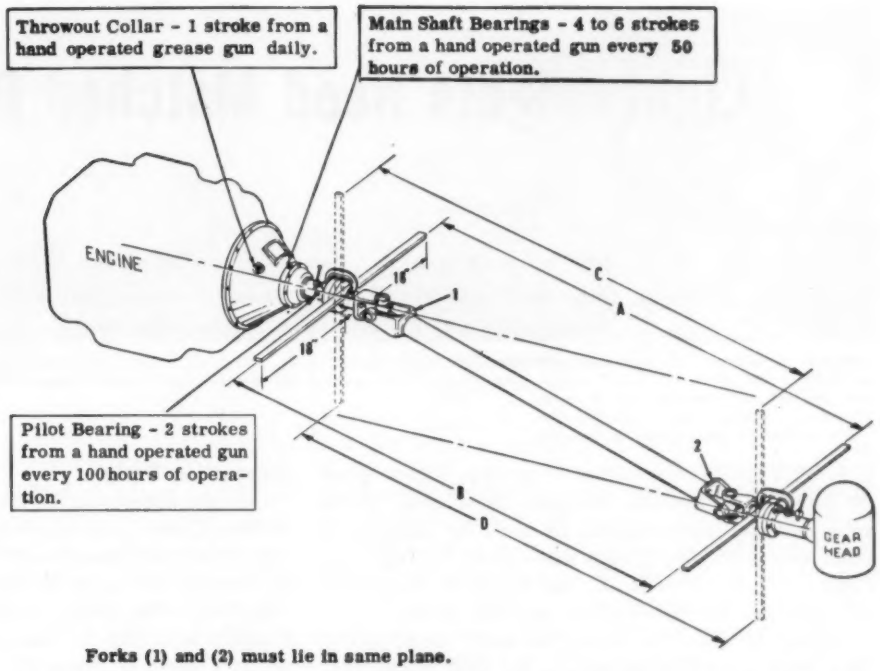

Throwout Collar - 1 stroke from a hand operated grease gun daily.
Main Shaft Bearings - 4 to 6 strokes from a hand operated gun every 50 hours of operation.
ENGINE
18"
18"
C
A
1
2
B
D
GEAR HEAD
Pilot Bearing - 2 strokes from a hand operated gun every 100 hours of operation.
Forks (1) and (2) must lie in same plane.

Fig. 1. Distance A should be equal to B within 1/8-in. and C equal to D within 1/8-in. when measured 18-in. out from the centerlines of the shafts. The engine is moved to bring distances within the required limits.

10. When proper end play is obtained lock adjusting nut and complete assembly of PTO.

11. Pack bearings and bearing cavity with grease before starting.

PTO Lubrication

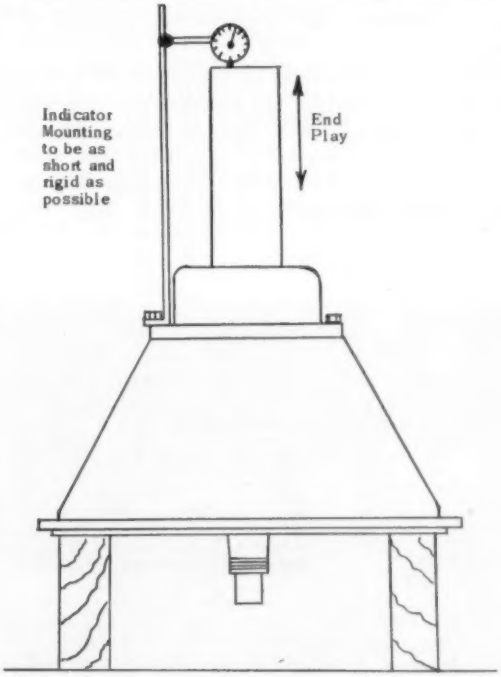
Proper lubrication of the power take-off is essential for satisfactory performance. A high-grade grease gun lubricant should be used. The grease selected should be recommended for anti-friction bearings and should have a minimum melting point of 300°F.

Lubrication points and frequency for Twin Disc Power Take-Offs are given in Figure 1. For other power take-offs, consult the manufacturer for lubrication instructions and recommendations.

Chart lists the end play limits recommended by the PTO manufacturer for different model power take-off output shafts.

BRG MFG'S NUMBER	TWIN DISC NUMBER	RECOMMENDED END PLAY	USED IN MODEL	DRAWING NUMBER
568-563	M-282	.009-.012	B-114 SP-114P	X8409A X9643
594-592A	M-215	.009-.012	B-118 B-218P SP-314P SP-314P	X7243A X7189B X9585 X9585A
593-592A	M-214	.009-.012	B-214P SP-214P	X8295A X9596

Fig. 2. Here's method of checking power take-off output shaft end play with a dial indicator to see if it's within limits.



Lightweights Need Matched Power

Low center-of-gravity, high-speed trains of the Talgo type need specialized diesel locomotives for best performance. Third-rail operation further improves utility and flexibility.

LIGHTWEIGHT, low center of gravity, higher speed trains need specially designed locomotives. These units must be high-powered, yet must be compact to match the dimensions of such trains as ACF's Talgo and Pullman-Standard's Train X, The Fairbanks Morse Co. has developed a locomotive for just such service.

Specifically, two F-M "Speed Merchant" diesel-electric locomotives were built for hauling the New Haven Railroad's new train the "John Quincy Adams". This is an ACF Talgo-type train running between South Station in Boston and Grand Central Station in New York City. The two locomotives, one at each end of the train, will operate in multiple, controlled from the leading cab. Both units are arranged to operate on either diesel or third-rail power.

A power unit at each end of train eliminates terminal turn around at these stations (both dead end). Minimizing the interval between terminal arrival and departure, facilitates the extensive use expected of this equipment.

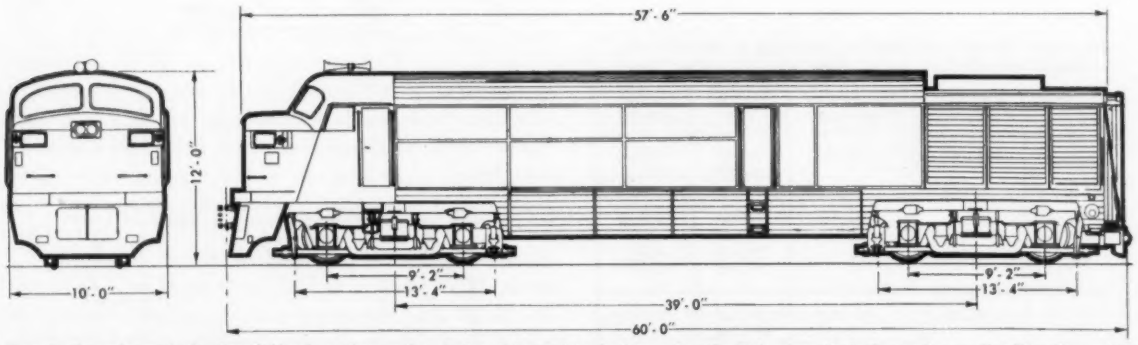
High-speed, light-weight locomotives using both diesel and third-rail power did not introduce any basically new operation to this railroad. However, the combination of these two power sources in connection with head-end auxiliary train power requirements results in a system quite different from anything previously used.

Locomotive Design

Principal dimensions are shown. However here is some additional data: nominal rating for traction is 1200 hp; total weight fully loaded is 216,000 lb, of which 110,000 lb is on the two pairs of driving wheels in front truck (rear truck is an idler); starting tractive effort at 30% adhesion is 33,000 lb; continuous rated tractive effort (at 23.5 mph) is 15,000 lb; wheel diameter is 40-in.; lube oil requirement is 300 gal; fuel tank capacity is 725 gal; the coupler contains connectors which trainline all locomotive control wires and train service functions. Coupling locomotive to train automatically makes all connections for operation.

Two unusual body construction features are: (1) main sills are set on 69-in width centers, and have a drop mid-section to permit mounting the engine with its lower crankshaft center line 48-in. above the rail. This allows a roof structure over the engine 12-ft above the rail. Underframe structure can withstand a buffing moment of 12,200,000 in. lb. This is higher than in any other F-M locomotive.

Center of gravity height of sprung mass above plane of bolster coil springs (with friction type snubbers operating in parallel with springs) is about 24-in. It is 40-in. in a typical streamlined locomotive. Lateral stability obtained by downward shift of center of gravity,



Overall dimensions of the Speed Merchant locomotive designed by Fairbanks-Morse for the Talgo-type train in service on the New Haven RR.

The "John Quincy Adams", lightweight, low center of gravity, 5-car Talgo train is pushed and pulled at 115 mph by two FM diesel-electric powered locomotives between N. Y. and Boston.

Control station has controller at left with reverse lever below it. Oval knob on panel is for switchover to 3rd rail and push-button is for starting engines in locomotives. Brake controls are at right.

and increase from 60 to 97-in. of centers of bolster coil springs results in substantially less lean or roll of the body with respect to trucks. This reduces lateral displacement of the center of gravity permitting higher speed on curves. These features complement similar performance characteristics of the ACF Talgo cars, and the train hugs the track on curves.

Locomotive Power Plant

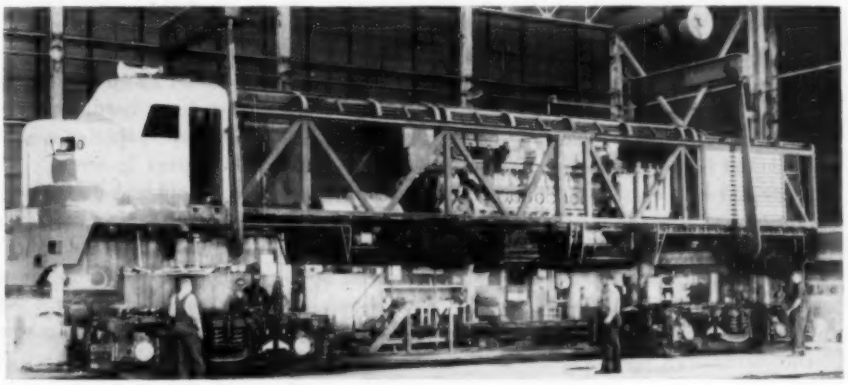
In the Grand Central zone the locomotives must operate on 600-v, d-c third-rail power; between Woodlawn, N. Y. and Boston, on diesel-electric power. In addition, 440-v, 60-cycle, 3-phase, a-c power is continuously applied to cars for heating, cooling, ventilating, lighting etc.

Each locomotive has a 1720-hp, 8-cyl, F-M Model 38D8-1/8, OP diesel operating at constant speed (850 rpm) and variable load. It drives the main traction d-c generator through a flexible coupling. A 600-v, d-c auxiliary generator (which acts as a motor in third-rail operation), and a 3-phase, 56.7-cycle, 436-v, 233-kw alternator are driven through an overriding clutch mounted on the main generator shaft. A standard 12-kw, 75-v, d-c generator and exciter are belt-driven from the overriding side of this clutch. The auxiliary generator provides power for battery charging, controls, lighting, and alternator excitation. All electric equipment was built by the General Electric Company except four auxiliary d-c motors which were made by F-M.

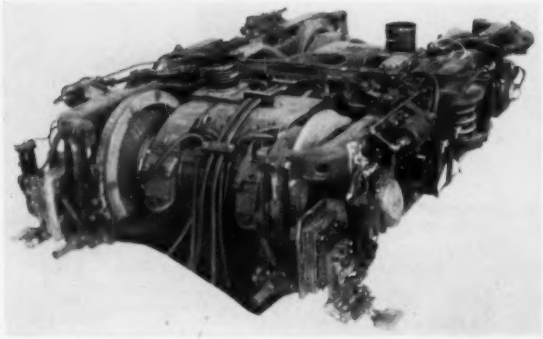
Advantages of using a single engine instead of a combination of main and auxiliary engines are: (a) less first cost; (b) less weight; (c) less space required; (d) minimum equipment required to convert from engine-drive to electric motor-drive for third-rail power of auxiliaries and train service generator; (e) no duplication or complex consolidation of engine cooling systems; (f) only one engine cranking operation on each locomotive unit for changeover from third-rail to diesel-electric operation; (g) minimizes maintenance and costs.

During layover at Grand Central, engine coolant is maintained at a minimum of 125°F by immersion heaters connected to 600-v third-rail power. This permits both engines to be started soon after the train emerges from the underground terminal, and set for full-speed, full-load shortly after warm-up, subject to a lube oil minimum temperature limit-switch. The system completes transfer to diesel-electric operation long before reaching the end of the third-rail.

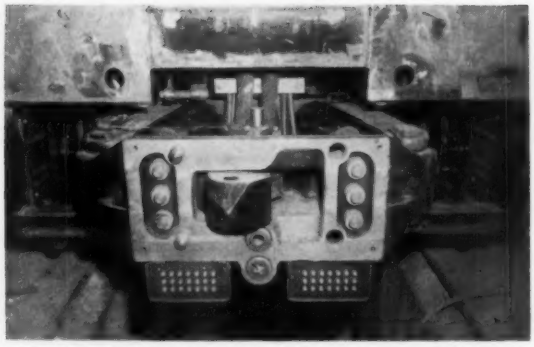
The engine room is a pressurized plenum chamber. All air is taken at roof level. A motor-driven blower, with a capacity of 20,000 cfm at 0.5-in. of water, forces the air through a set of self-scavenging centrifugal dirt separators. All equipment in the engine room draws on this clean air. Air for the diesel is cleaned again in



Locomotive is lowered on trucks. Single 1200-hp OP diesel engine that provides both traction and train service power can be seen. Unit can be switched to 3rd-rail power while train is in motion.



Four-wheel truck at cab end of locomotive is powered by two GE-752 traction motors which can be supplied from main diesel-driven generator or from 3rd rail through retractable shoes.



Coupling device automatically trainlines all locomotive and train service functions. Duplicate connectors insure contact.

centrifugal separator intake air cleaners which are continuously scavenged through aspirators in the exhaust stacks. The main generator and other rotating equipment are cooled by self ventilation, discharging a high percentage of the cooling air to the atmosphere.

The pressurized plenum chamber also overcomes the disadvantage of seepage of dust at seams, flashing strip, door seals and floor grommets, in many conventional cabs which have a slight vacuum. This is especially beneficial for the trailing unit which encounters the dust or snow raised from the roadbed by the leading locomotive and train.

Each traction motor is force-ventilated with outside air by a motor-driven blower directly below the cab. The air is cleaned by skimming vanes on the outer periphery of the blower scroll.

The engine cooling system is housed in a separate section at the rear of the main engine room. Coolant radiators, inlet shutters, and the d-c motor-driven exhaust fan are located here. For third-rail operation, forced-ventilation-type traction motor accelerating resistors and associated inlet shutters are arranged at the extreme rear of this section.

The fuel tank is located between the two radiator banks, and shaped to give minimum interference with cooling air flow. A door permits passage through this section to the train.

Electric Propulsion Equipment

The traction generator is separately-excited and has a series winding for engine starting. Means of excitation differs radically from that used on conventional diesel-electric locomotives since the engine must run continuously at full speed to provide 440-v power for train auxiliaries. Since the traction generator operates continuously at 850 rpm, all control of traction power must be provided by field control through the amplidyne exciter.

Two GE-752 standard traction motors are used in the front truck of each locomotive. For diesel-electric operation, the motors are always connected two in parallel, full and shunted field.

During 3rd-rail operation the traction motors are in series on full field. Automatic resistor control gives smooth acceleration in 12 steps under control of a current relay. Although notching is automatic, it is under control of the enginemen who may vary the rate of acceleration with the same throttle handle used for diesel-electric operation.

Since a single engine drives both the traction generator and the variable load alternator, two generator characteristics are used to get the available horsepower for traction. Each is in excess of 1200 hp—a total of 2400 hp for the two locomotives.

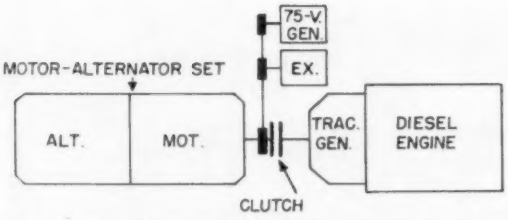
Train and Locomotive Auxiliaries

Train auxiliaries such as lighting, heating, ventilating and miscellaneous equipment operating on 440-v, 3-phase, 60-cycle power, are desirable because of standardization, cost and availability. Therefore, 60-cycle power for train auxiliaries operating on either 3rd-rail or diesel-electric power was a necessity.

This is readily possible on 3rd-rail power by using a motor running at 720, 900 or 1200 rpm. When diesel-driven however, the alternator runs at 850 rpm with a corresponding frequency of 56.7 cycles. To operate inductive devices rated at 60 cycles at this reduced frequency but on rated voltage, would result in higher current consumption and overheating. To prevent this, a-c system voltage was dropped in proportion to the frequency (from 440 to 436 v) for both 3rd-rail and diesel-electric operation.

A 233-kw alternator on each locomotive provides ample reserve power for all requirements. The maximum electrical demand for one three-unit articulated car is about 55 kw, or 275 kw for the five-car train. The cars depend on head end power for normal operation but they have batteries and trickle chargers for emergency use. Except in severe cold weather, the needs of all five cars could be handled by just one of the two locomotives without cutting into traction power.

The radiator and resistor cooling fan motor, two traction-motor blower motors, pressurizing-fan motor, and air compressor motor, are 600-v, d-c machines. When operating from 3rd-rail power these are connected directly. The large d-c auxiliary machine then operates on 3rd-



Arrangement of the diesel and electrical equipment in locomotive.

rail current as a motor—its field energized by the amplidyne exciter which it now drives as well as the alternator and the 75-v, d-c control generator.

When operating on diesel-electric power the motors are fed from the large d-c machine (attached to the alternator), which now acts as a 600-v generator with constant field.

Power Source Transfer

In changing from 3rd-rail operation after the engines have been started and brought up to 850 rpm, the throttle is moved to idle position, and a transfer switch from 3rd-rail position to diesel-electric position. When motor-alternator set speed equals engine speed (which is slightly lower than alternator speed when driven by 3rd-rail power) the overriding clutch engages. The d-c machine (generator), the alternator, the exciter and the 75-v control generator are then driven by the engine.

Power and auxiliary equipment circuits are changed by a multicontact power contact switch. Circuits are interlocked so that no change can take place until the throttle has been moved to idle position. This insures a smooth transfer under control of the engineman. As the throttle is advanced after transfer it controls excitation of the main generator, and therefore its power output. When the train leaves the 3rd-rail zone, the engineman's transfer switch is moved to a position which retracts the 3rd-rail shoes.

In changing from diesel-electric to 3rd-rail operation, essentially the reverse of the foregoing procedure is followed.

Conclusion

The two locomotives, each using the nominal 1200 hp available for traction, can bring the five-car Talgo to a speed of 80 mph on a level track in 4.45 minutes, in a distance of 4.2 miles.

Clasp-type brakes with composition shoes on all wheels produce a retardation rate of about 1.5 mph per second when a brake shoe force equal to only 35% of weight of locomotive is applied.

These high rates of acceleration and retardation permit unusually fast schedules in frequent-stop service. The NH Railroad expects to cut travel time between New York and Boston to less than three hours. It is their objective to match airline time (with city-to-airport time included) while offering the advantages of all-weather service and economy.

Free-Piston Turbine Engine Tested in Tractor by Ford

PICTURED at Ford proving grounds pulling a tow dynameter which measures power, this experimental "Typhoon" tractor represents a new approach to farm power. This is claimed to be the first time that a one-cyl free-piston engine has been used to power a farm tractor.

Able to run on a wide variety of hydrocarbon fuels including many farm products, the engine produces heated gases to drive a turbine. Typical of free-piston gasifiers as opposed to gas turbines, the power gases are low enough in temperature so that costly high temperature-resistant metals are not required in the turbine.

For initial test work, Ford engineers held power of the "Typhoon" down to the useful level of 50 drawbar hp, about half its potential.

Functionally designed and equipped with necessary hydraulic systems and power take-off shaft to operate farm implements, the "Typhoon" has a 99-in. wheelbase, 14-in. longer than the largest Ford tractor now in production.

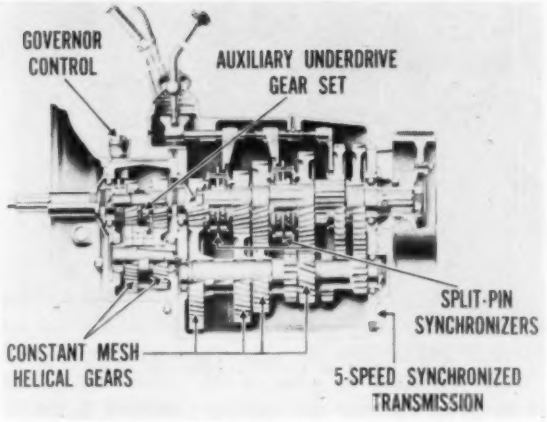
In demonstrations, the free-piston turbine engine tractor showed high starting torque, instant throttle response, evenness of power flow and smooth lugging power, according to Ford. Implements, operated by the tractor's power take-off shaft, were controlled independently of the tractor's forward motion.

Several advantages seem apparent with this type power, reports Merritt D. Hill, general manager of the Tractor and Implement Division. Fuel economy appears promising. Engine friction is lessened by fewer moving parts. Vibration is decreased through inherent balance of the engine. It can use less volatile oils and there is no high tension electrical system. No lengthy warmup time, no supplemental fuels or spark ignition system are required.

Though a long way from actual production, years, in fact, the free-piston turbine engine is being intensively tested and developed.

Semi-Automatic Transmission Improves Drive Flexibility

"Kickdown" to underdrive range provides added gear reduction when needed. Ease the accelerator and you are back again when the need passes.



Clark's semi-automatic truck transmission is a combination of a 5-speed synchronized transmission and auxiliary gear train.

CLARK Equipment Co.'s "StepMatic" is a new semi-automatic heavy-duty truck transmission. It minimizes shift lever and clutch pedal manipulation and reduces the need for skilled gear shifting.

The StepMatic is a combination of 5-speed synchronized transmission and an auxiliary gear train. The auxiliary is composed of a direct and an underdrive gear set which are semi-automatically engaged. The underdrive gear ratio splits the geared steps of the transmission into ten closely spaced gear ratios. Thus the gear train can be selected for optimum engine operation. Extensive field testing shows that fuel economy as well as savings in engine and transmission wear are obtained.

Regardless of the gear in use a driver can get additional gear reduction and power immediately by floorboarding the accelerator, or pushing a button on the dashboard, or shift lever depending on the arrangement. This shifts the unit into underdrive and provides additional gear reduction. The auxiliary automatically returns to direct-drive when the driver relaxes the accelerator.

With the StepMatic a truck can usually be started in second even under severe operating conditions. This avoids the normal difficulty of shifting out of low into second and the resulting loss in vehicle speed. Starting with the unit in second, the additional ratio of the auxiliary is automatically added to the second gear ratio. After starting, the shift to conventional second is made quickly by simply relaxing the throttle.

StepMatic Operational Details

Engagement of the underdrive ratio is controlled by a governor and a kickdown switch. The governor is driven by the StepMatic input shaft. The kickdown switch which completes or breaks the circuit actuating the shifting mechanism can be mounted on the dashboard, under the accelerator or on the shift lever.

At engine speeds at or below idling the unit is always in underdrive. At increased speed the governor makes contact to complete a solenoid valve circuit. Air or vacuum then actuates a cylinder which compresses a spring to put force on the auxiliary shift lever. This tends to shift the unit into direct gear. However, it doesn't shift to direct-drive until the driver relaxes the accelerator. This produces the torque reversal which permits the clutching gear to shift into direct.

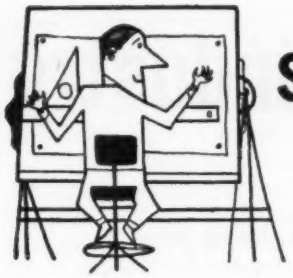
When the engine returns to idle the governor breaks the solenoid valve circuit. The cylinder return-spring aided by the helical sliding gear thrust tends to automatically shift the unit into underdrive. This takes place when tooth load on the clutch teeth is reduced as in normal deceleration.

The governor controlling action takes place within the idling speed range. At high speeds the kickdown switch controls the unit. When operating conditions require added gear reduction the driver actuates the kickdown switch. This breaks the solenoid valve circuit and the cylinder return-spring tends to shift the unit into underdrive. This can't be completed until torque reversal takes place. Instantaneous torque reversal is accomplished by momentarily cutting off the engine fuel supply through action of the kickdown switch.

When shift is completed, a remake switch instantaneously restores fuel supply. The unit also preloads itself for the shift into direct-drive, but remains in underdrive until the operator relaxes the accelerator.

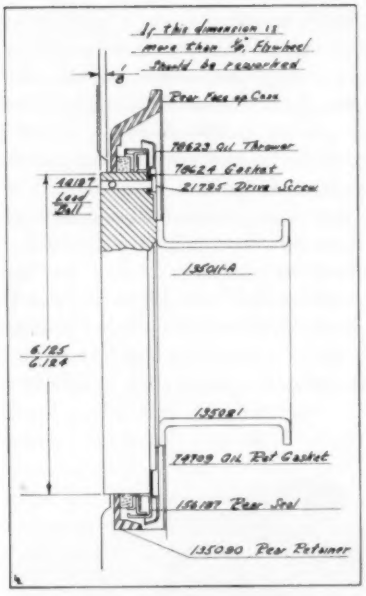
A reverse lockout switch prevents any upshift to direct-drive while in reverse gear. When the main transmission case has shifted into reverse, a ramp on the reverse rail pushes the switch plunger and breaks the governor circuit.

The 10-speed unit is available in two sizes, Model 303-X rated for engine torque output of 300 lb ft, and about 5¾-in. longer than a conventional 5-speed transmission; and the 400-X, rated for 425 lb ft torque and 6-7/16-in. longer than conventional 5-speed units.



service section

Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you



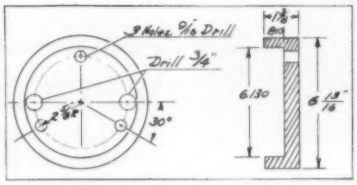
Installing Face-Type Rear Oil Seal & Retainer on Waukesha Engines

Future production engines in the Model 135 series will be built with a #156197 rear oil seal and #135090 rear oil retainer. This type of seal has a flat cork surface with a light pressure spring to hold the seal against the machined contact area of the retainer inner face as shown.

This seal and retainer may be applied to engines now in the field, providing they *do not* have spiral oil return grooves in the crankshaft rear flange. Crankshafts with this spiral groove require a retainer with part number 140190-C without a groove for a seal rope. Actual inspection of the crankshaft flange is necessary to determine if an engine can be equipped with the face-type rear seal.

To install the new seal and retainer.

1. Remove flywheel and loosen oil pan capscrews so old retainer may



be removed. Removal of the present 78623 oil thrower is unnecessary.

2. Carefully clean all dirt, gum, carbon, and sludge deposits from the seal and shaft area. The shaft rear flange and seating surfaces should be perfectly clean and polished free of burrs or nicks.

3. A suitable seal installing tool is necessary to locate and square the seal. The accompanying sketch shows a tool which may be made from either steel or aluminum about 1⅜-in. thick.

The only important dimensions are the 0.810-in. depth of counterbore and the 6.130-in. counterbore diameter. The depth is important because it must allow the face of the counterbore to draw up flush and square against the rear face of the shaft flange, thus squaring the seal. The diameter must be held close because excess clearance may result in shearing the edge of the cork between

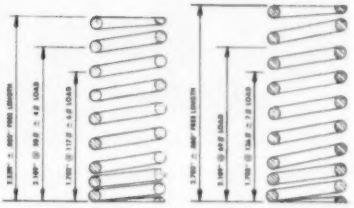
(*Continued on Page* 71)

IH Lube Oil Filter Element

All engines which are equipped with full flow filtration on 2T-55 and 2T-75 tractors and Model 65 and 95 Payhaulers should use lubricating oil filter element 268 462 R91 (2 required per engine).

Full flow filters became effective with serial number 701 for the 2T-55 and serial number 601 for the 2T-75.

All old model 2T-75 units which were converted to the increased horsepower turbocharged engine will also use lubricating oil filter elements 268 462 R91.



New Valve Spring for Cummins Engines

A new intake and exhaust valve spring, Part No. 106664, has been released for use in all JT, JN and JNS cylinder heads. The new spring is shorter than the former 70845 spring with lighter loading as shown by comparison in sketches.

Use your old style springs but do not mix with new style under the same crosshead. Always use in pairs of two old-style or two new-style.

Valve Head Breakage

A trucking company had had quite a bit of trouble with the exhaust valve jerking the heads off and this valve head, of course, knocks a hole in the piston.

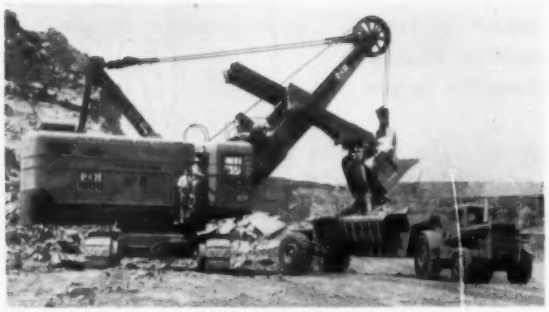
A solution as supplied by the Technical Committe of the AERA indicated that the trouble is caused by overspeed of the engine. While this is a related factor, it is suggested that the actual cause of the breakage is high velocity valve seating.

In his presentation 'Diagnosing Valve Failures', Mr. V. C. Young, Chief Engineer, Valve Division, Eaton Manufacturing Co., said to the Automotive Engine Rebuilders Convention in Cleveland, Ohio, on May 10, 1955, that: "The second type of failure is caused by only one thing: seating the valve at a speed or velocity that imparts a load too great for the material to withstand."

His referral to type of breakage was to that "which occurs at the neck

(*Continued on Page* 71)

news of our industry



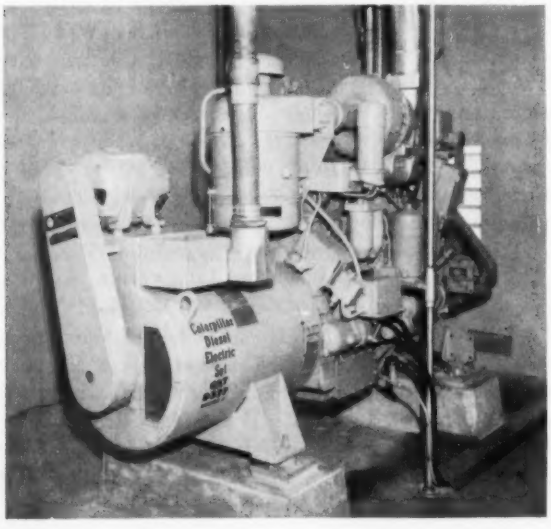
Harnischfeger Highway Helper

Behind the scenes in highway construction is this P & H Model 1600 6-cu yd, electric power shovel, one of a fleet of ten. It is breaking records feeding the enormous appetite of new thruways for cement. Contributing to the bonus production of this excavator are the P & H Magnetorque hoist drive for greater bail-pull and the stepless electronic control for optimum speeds in all shovel functions.

Stationary Stand-by Power

In Miami, a Caterpillar D337 (Series F) turbocharged diesel engine is the power behind Station WCKT when commercial power fails. When that happens, power is supplied within seconds by the Cat stand-by electric set, and reception is restored with little or no change in either audio or visual quality.

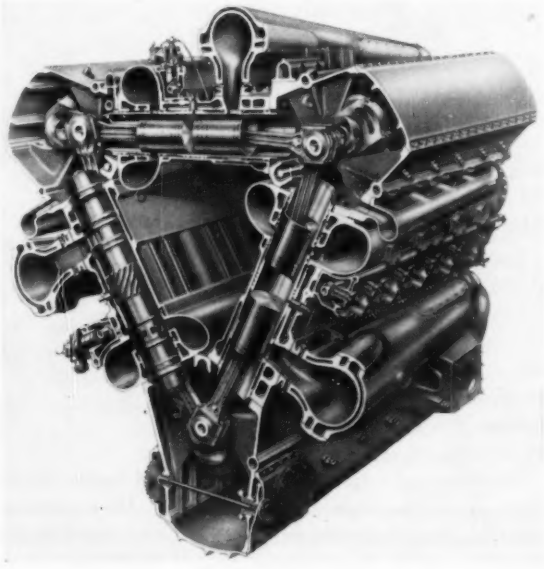
The turbocharged diesel powers a 150 kw, 480-v, 3-phase, 60-cycle generator. The electric set is equipped with an automatic start-stop mechanism, powered by four Southwind batteries. Cooling is provided by a 75-psi Young radiator, and a Trojan battery charger assures starting batteries are brought back to full strength after each emergency start.



U. S. Army Orders Napier Deltic Diesel

Engineer Research and Development Laboratories of the United States Army have contracted with D. Napier & Son, Ltd., for a 43,000-lb compressor set, consisting of an 18-cyl Deltic diesel engine and two Howden rotary positive displacement two-stage compressors, for use with a mobile liquid oxygen plant. The set will supply up to 30,000 lb of dry air per hr at 100 psi.

The Napier Deltic engine, a high-speed, water-cooled, opposed-piston, compression-ignition two-cycle, is smaller and lighter than many conventional diesels of comparable power. Its compactness is gained by the triangular arrangement of its cylinders, shown in this photograph, with a crankshaft at each apex of the triangle and two pistons working in each cylinder. Its low weight and space-saving characteristics make it particularly suitable for powering fast naval craft and mobile plants.



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Diesel Parts Off For Scotland

Shipment of parts is on its way to Cummins Engine Co., Ltd., Shotts, Lanarkshire, Scotland, from the parent company at Columbus, Indiana. At Shotts, these parts, combined with components made in the United Kingdom, will be assembled into Cummins diesels. Within two years, they expect Cummins engines shipped from Shotts will be 100% British manufactured.

Risk in Mixing Greases Told in Army Report

Use mixed greases without an in-service test and you'll risk equipment failure. This warning is in a report issued by the Office of Technical Services, U.S. Dept. of Commerce, of Army research into the compatibility of eight commercial binary lubricating greases.

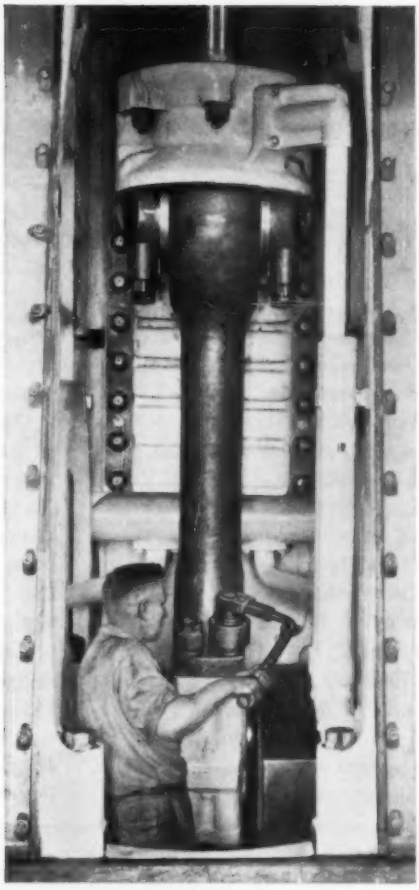
The safest plan, advises the report, is not to lubricate with mixtures of different types of greases. If they must be used, a compatibility test should be run involving the greases, the equipment to be serviced and the actual conditions of operation. The ASTM wheel bearing grease tester was rated by the Army a better laboratory indicator of compatibility than the mechanical worker.

LOMA Technical Meetings

So more men can attend, the Locomotive Maintenance Officers' Assoc. is making the rounds of eight cities with important pre-convention technical programs. Cities where meetings were already held are Jacksonville, Louisville, Cleveland, Houston and St. Louis. Coming up are sessions in Denver on May 27; St. Paul, May 28 and the final round-up in Chicago on Sept. 16-18.

At St. Louis the data-packed program included presentation of a paper on "Economical Methods of Cleaning Steam Generators and Appurtenances". In Denver, a paper will be read on "Chrome Plated Liners and Crankshafts and Lube Oil Cooling and Filtering Systems". The topic in St. Paul will be "Maintenance and Rebuilding of Traction Motors and Main Generators".

Snap-on tools are used in the assembly of world-famous Nordberg diesel engines. Pictured is a large *Snap-on* ratchet and socket wrench tightening a connecting rod bolt. Cylinders in this giant have a 29-in. bore, 40-in. stroke. Note specially curved handle which permits swinging tool within engine framework.



DIESELS SERVE THE WORLD

Snap-on serves the diesels

From original assembly to field erection and service, you'll find sure-fitting, long-life *Snap-on* tools at work on top-name diesel engines all over the world.

Husky *Snap-on* socket wrenches, impact and manual types, open-end wrenches, plus a wide range of other standard and special *Snap-on* tools, are prominent on diesel assembly lines.

Special kits of *Snap-on* tools are included by manufacturers for diesel erection and service when these engines leave the factory.

On the line and in the field, *Snap-on* Torqometers are depended on to tighten bolts and studs exactly to pre-determined tensions.

Throughout the diesel field, *Snap-on* tool sets are proudly owned and used for maintaining diesels, large and small, in every type of duty — trucks, construction equipment, power plants, marine service, railroad locomotives, and many others.

Find out how *Snap-on* tool specialists work closely with diesel manufacturers — provide individual tools and tool kits to fit their needs exactly. *Snap-on* branch offices and warehouses are located in 51 cities in the U.S. and Canada. Consult the yellow pages of your phone directory for nearest location.

*Snap-on is the trademark of Snap-on Tools Corporation.

SNAP-ON TOOLS CORPORATION
8064-E 28th Avenue • Kenosha, Wisconsin

news of our industry

Low Fuel Cost With Free Piston Engines

The free piston engine, now out of the laboratory, is ready to compete for power jobs, Arthur F. Underwood said at a meeting of the SAE. Large-size free piston-turbine combinations have a fuel economy in the range of similar size diesels and he adds smaller units will have similar economy shortly.

Savings of this form of power—essentially a diesel-powered pump or air compressor connected with a gas turbine—are based on its versatile fuel appetite. A test unit (1250 gas hp) at GM Technical Center operated with petroleum fuels ranging from gasolines to Bunker C, crude and shale oils.

In referring to economies of burning some of these fuels, Mr. Underwood made this statement: "It is often pointed out that any fuel which has a low tax at the present time cannot be expected to continue in a low tax bracket if the fuel becomes popular. This is undoubtedly true, but it would seem reasonable to expect a fuel having a lower production cost would cost less to the final consumer."

Trailmobile Produces All-Aluminum Flatbeds

Fifty all-aluminum flatbed trailers are rolling off Trailmobile's assembly line bound for Pacific Intermountain Express.

More pay load is possible because of their improved design and lightweight all-aluminum construction. Each weighs only 9460 lb fully equipped, roughly 1000 lb less than other aluminum models and more than a ton and a half lighter than steel versions.

Kaiser Aluminum cooperated in design of this new flatbed trailer. Delivery of these units represent completion of the first production run of all-aluminum, welded flatbeds in this country, PIE points out.

Heroism Substitutes for Safety Devices

"The International Operating Engineer", April, 1957, cites the heroism of Dell Logan and Norman Yongue in shutting down a runaway crane engine at great personal risk. They deserve all the best. But why was this demand made on them? When a governor rod broke, what happened to the overspeed trip? Where were the remote-control shutdown devices?

The article did not say whether someone had saved a buck by not installing such safety devices or if installed, whether they were checked periodically to insure functioning. In any case, there's an important lesson here. Positive shutdowns, both for fuel and air cutoff, are available and cost a lot less than it will take to get the engine running again—to say nothing of personal liability, property damage and cost of downtime.

Safety devices—installed and functioning—are cheap insurance. Messrs. Logan and Yongue may not be around when things happen.

"Hey! I hear NORDBERG has

"Yes, sir. They use aluminum bearings in their big gas-burning radial engines and haven't had a failure. Guess it's because only aluminum can handle 10,000 psi on projected area."

"More likely, it's because aluminum runs 20° cooler than ordinary bearings. You know, less burnouts and seizures."

news of our industry

Heat Pump Powered by Diesel

There's a huge shopping center in Southdale, Minneapolis, with a combined heating and cooling system. Heat pump and heat exchangers do the trick—powered by Minneapolis-Moline natural gas power units.

Briefly, in winter, heat is extracted from water in the subterranean glacial drift—then pumped back into the earth. In summer, heat from the air is transferred to colder water pumped up—and then back down again.

The M-M power units are equipped with water-cooled exhaust manifolds and heat exchanger base pans which transfer the heat thrown off by the exhaust gases, lubricating oil and the engine's cooling system.

Two huge penthouse fans suck in 120,000 cu ft of fresh air per min, passing over water coils which heat it to 75 deg in winter, cool it in summer, then disperse it through 75 shops.

New Records Scored In Trucking Industry

Every phase of the trucking industry seems to be on the way up. Data released in the annual report of American Trucking Associations confirms this.

To quote a few of the encouraging 1955 figures: Intercity ton-miles are up from $215 to $226 billion. Rural vehicle miles are at $70 billion—up $2 billion. Gross revenues of Class I, II and III carriers alone reached $5.5 billion—up from $4.7 billion.

On the other hand, private and for-hire trucks paid a huge tax bill on their vast operations. $1.9 billion went for special federal, state and local motor vehicle taxes. That's exclusive of property and income taxes. Estimates for '56 say these truck taxes will more than top the $2 billion mark. And the years to follow will show even a sharper tax increase because of the highway program.

For your copy of this statistic-packed "American Trucking Trends", write direct to the Association, 1424 Sixteenth St., Washington 6, D.C.

Diesel Power Plant Meeting

The July 15-17 Eighth Diesel Power Plant Conference promises to be an interesting one. It will be held at the Engineering Extension, Iowa State College. Among discussions scheduled are: Use of Residual Fuel; Meters; Gauges, Regulators; Lubricating Oil Problems, Portable Plants; Chrome Plating Cylinder Liners; and Preventive Maintenance.

Design Engineering Conference

Men concerned with design of new products will gather at the 1957 Design Engineering Conference, sponsored by ASME, on May 20-22 at the N. Y. Coliseum.

Discussions will cover such subjects as new materials, procedures in developing new designs and automatic control machinery. Papers will deal with metals and alloys for high-temperature use, new types of coatings, including vacuum metallizing and other vital topics.

(*Continued on Page* 64)

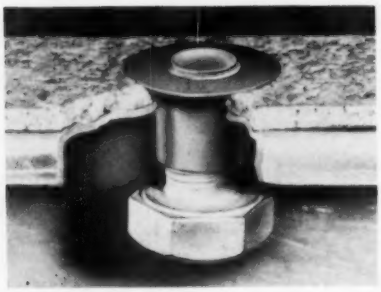
racked up over 40,000 hours on these Alcoa® Bearings!"

"I hear aluminum bearings roll the dirt particles right out. They embed better than bronze, but not as deeply as babbitt. Oil additives won't corrode them either."

"Do you know that solid aluminum bearings have no hard backing? They can't damage shafts if they fail. They also eliminate the bond fatigue problem since they're monometallic."

"The word is getting around that solid aluminum bearings, cast by Alcoa and machined by leading bearing manufacturers and users, are just about perfect. More information? Write Aluminum Company of America, 1888-E Alcoa Bldg., Pittsburgh 19, Pa."

new products



Gasket Guides Simplify Alignment

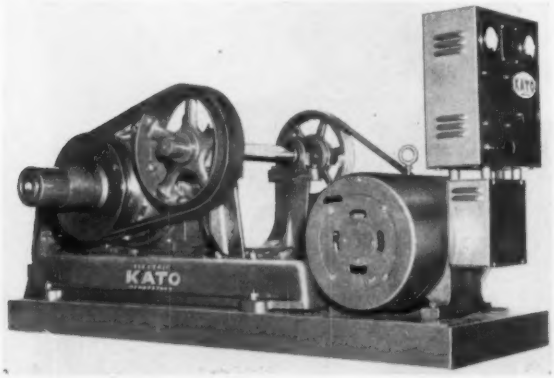
P & G Manufacturing Co. is marketing a mighty handy gasket gadget in sizes suitable for most trucks, tractors and industrial engines. These gasket guides are simply thin-walled plastic sleeves. This cutaway view of pan and gasket shows how the guide centers and holds the gasket in alignment with the bolt hole. It also suspends the bolt ready for speedy tightening. The guide compresses as the bolt is tightened making a permanent seal with the bolt threads, thus preventing oil seepage.

Variable Output for Kato Generator

Output frequency of this Kato 5-kw high frequency ac motor-generator set can be adjusted automatically by push-button control.

The variable-diameter pulley arrangement shown on the left in this picture permits frequency adjustment from 380 to 420 cycles per sec. The 14-pole, 5000-w alternator supplies 3-phase, 120/208 v current. Initial power, furnished by a 1½-hp, 60-cycle ac motor at 1800 rpm, operates a screw-type shaft for changing pulley diameter.

Another engineering achievement by Kato is a phase and voltage changer. This is a new type rotating electrical machine which converts single-phase, 115-v, 60-cycle alternating current to 3-phase, 230 v, 60-cycle current. Frequency is held constant within a fraction of a cycle from no load to full load.



Remove or Install GM Parts With Blower Tool Set

New on the market for any shop doing engine maintenance on Detroit Diesel engines, is a blower service tool set for Roots-type blower units. It's made by Kent-Moore Organization and has nine components based on manufacturer's specifications.

The service set is applicable to old and new Roots-type blowers used in GM Models 3-71, 4-71 and 6-71 diesels. Use of the set provides for correct removal and installation of gears, plates, bearings, seals and other parts. Kent-Moore states it minimizes risk of damage to precision machined surfaces of the blower parts.

Clark Adds 4-wheel Drive Fork Truck

A 20,000-lb capacity pneumatic-tire fork truck is latest addition to industrial truck line of Clark Equipment Co. It features 4-wheel drive and finger-tip direction controls. Named the Ranger-200, the 32,470-lb machine is designed for heavy duty in mud and over rough terrain.

For maximum power, a 4-speed, power shift transmission and a torque converter with 3-to-1 multiplication are coupled with a 143-hp GM diesel. Four-wheel or 2-wheel drive is obtained by moving a selector lever. A single lever on the steering column controls lifting and tilting movements. The Ranger-200 has an under-clearance of 14 in. and will travel 25 mph in both forward and reverse with a turning radius of 312 in.

Dust Protection For Turbochargers

American Air Filter's oil bath cleaner has been improved. The new Cycoil Type P low-resistance cleaner now offers increased protection of air intake against snow and water, and greater bug protection. For easier and less costly installation, the base has been redesigned.

Thorough mixing of oil with intake air and positive draining from filter pads insure cleaning efficiency. These features, plus advantage of perforated entrainment plate, provide dust protection—100% the maker claims—for turbocharged engines and centrifugal compressors.

Type P Cycoil is recommended by American Air Filter for any engine with low allowable intake resistance. Another Model P-V has redesigned Vari-Flow valves added on the entrainment plate for thorough cleaning action regardless of air rates capacity at which engine operates.

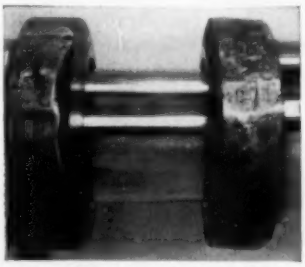
Aerosol Degreaser

Stewart-Hall Chemical Corp. provides an easy way to remove stubborn gums or grease. Just spray "Zipp" on and wipe or rinse away the dirt. The aerosol can is handy for cleaning hard-to-reach spots. The maker says Zipp dries quickly without film or vapor. It will not short electrical equipment, is non-corrosive and non-flammable.

THIS CRANKSHAFT JOB NEEDS A SPECIALIST

This is specialized work, rebuilding crankshafts—intricate, exacting, and naturally expensive. It's the kind of work that demands a specialist . . . and we are just that!
We've specialized in rebuilding crankshafts, because since 1916 we've *made* crankshafts. And who knows better than a maker what are the "musts" of a sound, economical repair job. We'll take your worn crankshaft and rebuild it, if salvagable, through the carefully controlled steps of grit blasting, replating, regrinding and thorough inspection. And we'll deliver it back with a guarantee for 100% performance that only a manufacturer-specialist can provide. May we quote on your next job?

For more details on crankshaft repair write for Bulletin RC-3



This is a finished, repaired crankshaft, after processing by National Forge.

NATIONAL FORGE AND ORDNANCE COMPANY

Irvine (Warren County), Pa.

new products

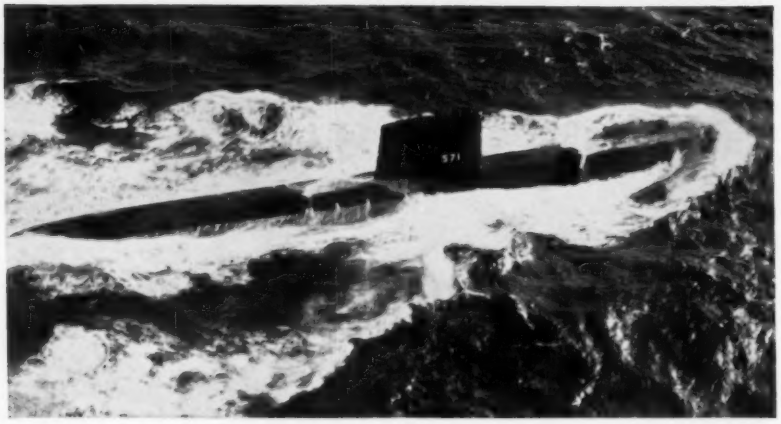
Steam Cleaner

For removing dirt and grease from industrial machines and construction equipment, Homestead Valve Mfg. Co. has announced a new Hy-pressure Jenny. This Model 1858 cleaner is designed for extra-heavy duty cleaning—either single gun or two gun operation.

Finger-tip control of flushing and rinsing capacities up to 480 gal per hr is a reported feature of the unit. It has 180-gal per hr steam cleaning capacity. The model is available in oil-fired or gas-fired units in stationary, portable or trailer-mounted types.

Utility and economy features cited by Homestead are: automatic electric ignition; independent fuel system; slow-speed positive displacement pump with stainless steel disc check valves; air-bell and alleviator hose for smooth operation.

For over 42,000 nautical miles . . .



DETROIT CONTROLS

guarded both men and machinery aboard the Nautilus

Never before has a submarine chalked up such a performance record. And never before has Detroit Controls had such an important part to play in protecting lives and equipment.

Used as key controls on the Nautilus' air conditioning and refrigeration systems, Detroit Controls are also used on her alarm systems to warn of overheating or low lube oil pressure.

For nearly 30 years Detroit Controls have supplied pressure and temperature controls for naval and marine vessels. These specifically designed controls limit, regulate or guard pumps, diesel engines, heating and air conditioning systems, lube oil temperature and pressure alarms, desuperheaters, clutches and other marine installations.

For complete information write for Catalog 100-F.

5900 Trumbull Avenue
Detroit 8, Michigan

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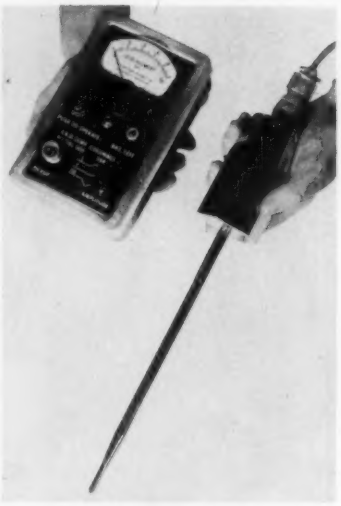
Canadian Representatives: RAILWAY AND ENGINEERING SPECIALTIES LTD., Montreal, Toronto, Winnipeg



Vibration Meter Detects Trouble

Unusual vibration indicates trouble-in-the-making. With the new vibration testing instrument put out by Research & Development Corp., you can determine excessive vibration. More than that, this Model 305 vibration amplitude meter can detect incipient failures and thus avoid costly downtime.

Self-powered and weighing just 24 oz, the instrument is easy to use even in tight corners.

82,000-lb Scraper

Caterpillar has replaced their Model 90 scraper with new No. 491 which has 12,000 lb more payload capacity. It's for use with Cat D8 and D9 tractors. The new unit also has 15-in. wider apron opening for thorough ejection.

Handy Tote Box

Good idea for parts storage and handling is the new Miracle tote box made by Paige Company. It quickly pops open for use and pulls flat for storage. Made of heavy-duty, double-walled corrugated in two sizes, the maker says their tote box can be collapsed 50 or more times without showing wear.

Covers make the boxes dust-free for storage of inactive parts or plant records. Polyethylene liners for the tote boxes are available, too, when storing or transporting wet or greasy materials or parts.

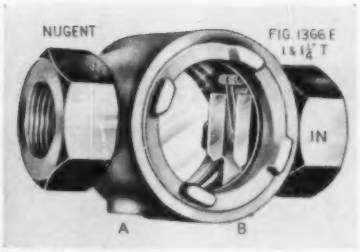
new products

Actuating Motor For Remote Control

For those concerned with automatic, remote-controlled engine installations, there's a new electric motor on the market. Named the "Actionator" by Industrial Div., Minneapolis-Honeywell Regulator, it's a reversing capacitor-type motor.

The unit is designed to operate rotary, slipstem and butterfly valves, dampers and other final elements in automatic control systems.

Two basic models are available. Model M630 is engineered for 2-position and floating control and Model M930 for proportioning control. Both units are compact—6 in. diam, 10 in. wide and weigh 11 lb. They incorporate a gear train which permits selection of timings from 7.5 sec to 120 sec, depending on the model. To prevent "coasting" in any of the positions, the motors have a built-in internal brake capable of holding a dead-weight up to 200 lb.



Better Flow View

A fitting has been designed by Wm. W. Nugent & Co., Inc. for easy view of the flow of liquid in a pipe line. The windowed device, visible from both sides, has a spring compensated, hinged indicator gate which moves in proportion to the flow.

These fittings are available in sizes from ⅜ in. to 6 in.—in brass, cast iron or steel—flanged or tapped. They may be installed horizontally, vertically, diagonally or even upside down. The units may be equipped with electrical contacts (A and B) to operate a bell or light to signal stoppage of flow.

"Soft" Hammer

Replaceable molded nylon faces for Chicago Rawhide jawhead and solid head hammers are now available.

Exhaustive tests led this firm to employ the specific molded nylon compound for its greater wearing quality. The nylon, they state, is acid, oil and moisture-resistant. Like rawhide, the nylon faces will not chip, spark, mushroom nor mar finishes. Added advantage is they will not shrink nor loosen in the head or face bore of the hammer.

New Shovel Crane

As a result of field research, Lorain has introduced an improved 2½-yd shovel crane. Model 85A incorporates many features for more safety and operating ease. The unit is powered by a GM Series 6-110 diesel with torque converter and tailshaft governor as standard equipment.

Greater glass area gives improved visibility. Lorain's 2-lever "Joy-Stick" metered-air controls and "Shear Ball" mounting are two mechanical features incorporated in the model. The 85A is convertible to crane, shovel, clamshell, dragline or hoe.

(*Continued on Page* 66)

Here's Why
PERFORMANCE IS BETTER WITH Bendix STARTER DRIVES

CHECK and COMPARE THESE FEATURES

- Starting motor can be mounted more easily and in more positions.
- Requires no actuating linkage—solenoid can be placed in any convenient position.
- Simple in design—has fewer parts—needs fewer adjustments.

It takes a truly outstanding product to receive over 100,000,000 endorsements. Yet, that's the number of Bendix Drives that have been installed. No other starter drive approaches this record of outstanding performance. That is why, whatever your type of diesel or whatever its purpose, it will pay you to specify Bendix* Starter Drive for the most economical installation and dependable performance. *REG. U.S. PAT. OFF.

ECLIPSE MACHINE DIVISION of Bendix AVIATION CORPORATION
ELMIRA, NEW YORK
Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N.Y.

organizational news

Henry Larsen

A-C Tractor Group Post

Henry Larsen is the newly appointed asst. general works manager, Tractor Group, Allis-Chalmers Mfg. Co., Milwaukee. In his new duties he will work with nine plants located throughout the country. A native of Denmark, Mr. Larsen joined A-C in 1930 shortly after coming to this country.

W. Feldman

E. Schwanhausser

Worthington Election

Walther H. Feldman has been elected president of Worthington Corporation. Edwin J. Schwanhausser is now vice-chairman and Hobart C. Ramsey continues as chairman and chief executive officer

Since 1922 Mr. Feldman had been with Electric Machinery Mfg. Co. which became a part of Worthington in 1944.

Mr. Schwanhausser joined Worthington in 1915 as a member of the engineering department.

J. Elliott

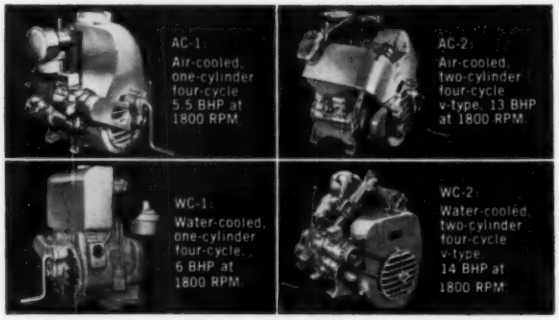
New Orleans Office For Cleveland Diesel

Cleveland Diesel Engine Div. of GM has opened a new sales office in New Orleans at 727 Baronne St. The firm says the move was necessitated by the favorable acceptance of the Cleveland diesel Model 498 turbocharged 2-cycle diesel.

Heading up the office is Joseph Elliott, marine sales representative. He has served this Division since 1941.

THE BIG 4 IN DIESEL POWER

AMERICAN MARC and Hallett combine their resources to bring you the finest small Diesels made to fit every job. Write today for full details and specifications.


AC-1:
Air-cooled, one-cylinder four-cycle. 5.5 BHP at 1800 RPM.
AC-2:
Air-cooled, two-cylinder four-cycle v-type. 13 BHP at 1800 RPM.
WC-1:
Water-cooled, one-cylinder four-cycle. 6 BHP at 1800 RPM.
WC-2:
Water-cooled, two-cylinder four-cycle v-type. 14 BHP at 1800 RPM.

AMERICAN MARC also manufactures Diesel generating plants from 3 to 10 KW (AC or DC, and industrial three-phase), Diesel pumping units from 4 to 1700 GPM, marine propulsion, refrigeration units and power-packages for other services. American MARC can adapt any of its Big 4 engines to fit every job requiring from 5 to 20 BHP.

SOME DESIRABLE SALES TERRITORIES ARE STILL OPEN. INQUIRIES ARE INVITED FROM REPRESENTATIVE DEALERS.

AMERICAN MARC INC.
DIESEL ENGINES
1601 West Florence Ave. Box 549, Inglewood, Calif.
Telephone OR 8-7174

AMERICA'S LARGEST MANUFACTURER OF AIR-COOLED DIESELS

GRIND CRANKSHAFTS IN THE BLOCK!
The Winona Lathehink Crankshaft Grinder has given fast, accurate service in the Automotive field for over 18 years. Now it's available to the Diesel field. With a new large hook, the standard grinder will now grind shafts up to 3½" in diameter in the block!
WRITE FOR DESCRIPTIVE LITERATURE AND PRICES.
WINONA TOOL MFG. CO.
WINONA, MINN. U.S.A.

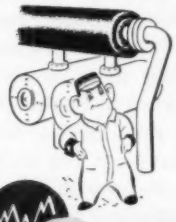
Intake and Exhaust NOISE

Pipe System PULSATION

Stopped with

BURGESS-MANNING SNUBBERS

The Burgess-Manning Snubbing Principle has been engineered to effectively eliminate the costly and nerve-racking problem of noise and pulsation. We have, for many years, specialized in the science, cause and effect of noise and pulsation problems. We have adapted the Burgess-Manning Snubbing Principle to many and varied problems in every branch of industry to increase production, minimize maintenance, eliminate this serious source of compensation claims and improve public and employee relations. Burgess-Manning Snubbers are available with such plus features as: air cleaning—or, spark arresting—or, surge control—or, water separating—or, heat recovery.



Let us engineer your noise and pulsation problems right out of existence.

Write for Case Histories.

BURGESS-MANNING COMPANY

Sound Engineering 751 East Park Avenue, Libertyville, Illinois

Dallas, Texas

KIENE® DIESEL

PRESSURE INDICATOR

gives compression and firing pressures faster

SIMPLE
RELIABLE
COMPACT

Send for Bulletin K-100

The Model K-100 Kiene Pressure Indicator accurately measures compression and firing pressures — assures the proper maintenance of diesel engines — helps prevent costly down time. Only one moving part — no friction or inertia effects — no complicated adjustments.

KIENE DIESEL ACCESSORIES, INC.

10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

organizational news

H. J. Louth

Ohio Crankshaft Works Manager

H. J. Louth has been promoted to works manager of Ohio Crankshaft and Camshaft Div. Before joining Ohio Crankshaft in 1942 as industrial engineer, Mr. Louth was with Mueller Brass Co. for ten years.

New VP at Kurz & Root

Eli Chappe has joined Kurz & Root Co. as vice president in charge of commercial sales. He will head up both export and domestic activities for motor and motor-generator set sales. Previously, Mr. Chappe was vice-president of International Diesel Electric.

New Cummins Building

Here's how the new facilities of Cummins Diesel Sales Corp., Cincinnati, will look on completion late this month. The new building is being erected on a two-acre site, directly adjacent to Highway 50 by-pass in Evendale, Ohio.

According to J. M. Mitchell, manager of Cummins' distributorship, about 50% of the 12,000 sq ft plant will be devoted to truck bay area, chassis dynamometer room, cleaning room and engine dynamometer room.

As distributor headquarters, the building will house a full line of parts and Cummins diesel engines, from 60 to 600 hp, for trucks, construction equipment, marine and industrial application.

Ralph G. Greer

Promotions at IH

Ralph G. Greer has taken over as manager of sales, Construction Equipment Div., International Harvester. He has served IH in various capacities for more than 23 years.

Warren H. Thompson has been named supervisor of sales development.

Also announced was the promotion of Leslie J. Lange as assistant to Mr. Greer.

Electro-Motive Promotion

Floyd H. Albert has been promoted to district sales representative in the St. Louis area of Electro-Motive Div. of GM. Back in 1936, Mr. Albert joined this company as a pipefitter.

(*Continued on Page* 67)

new literature

Triple Lock Hose Clamps

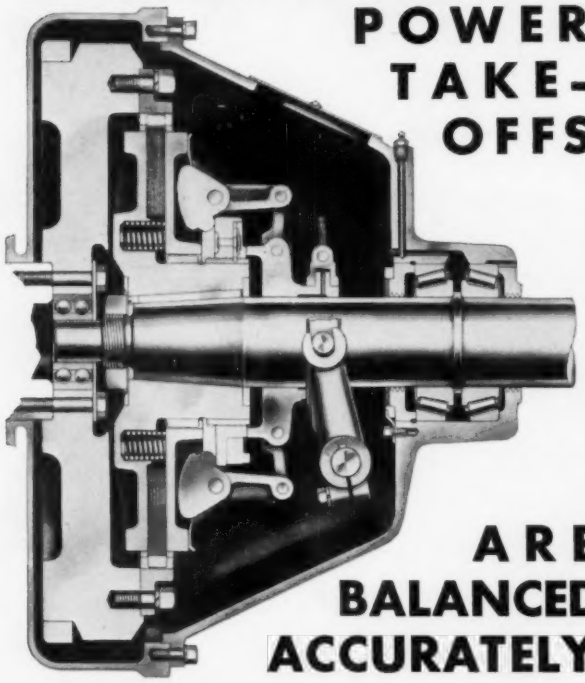
A little leaflet describes the triple-locking benefits of Punch-Lok hose clamps for use on high pressure hose, suction and discharge hose, wrapped insulation and hose repair in general. Also illustrated are Model P-1 Tool Set and P-38 Clamp-Master for applying these high-tensile steel clamps.

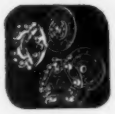
Workmanlike Catalog On Hose and Fittings

Designed primarily for use in the replacement field, a condensed industrial catalog on hose, fittings, socketless kits and self-sealing couplings, has been released by Aeroquip Corp. It is a ready reference—and most complete—with instructions for ordering, installation planning and assembly of Aeroquip hose and fittings.

ROCKFORD

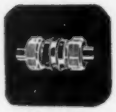
POWER TAKE-OFFS





Small Spring Loaded

Heavy Duty Spring Loaded



Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

ARE BALANCED ACCURATELY

SELF CONTAINED UNIT
WIDE RANGE OF SIZES
CONSERVATIVE RATING
ROLLER BEARINGS
FINE ADJUSTMENT
ACCURATE BALANCE
S.A.E. DIMENSIONS

* The clutches used in ROCKFORD POWER TAKE-OFFS are carefully balanced to prevent centrifugal force from affecting efficient operation. A special machine checks the balance of each clutch * within extremely close limits, before it passes final inspection.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD Clutch Division BORG-WARNER

1301 Eighteenth Ave., Rockford, Ill., U.S.A.

Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

Quick, Easy, Accurate Optical Gauge

Webber Gage Co. details the advantages of their Micro-Accurate optical height gauge in a new folder. Termed an extremely true yardstick, the gauge is quickly adjusted to measure heights up to 61 in. with accuracies of .000005 per in. of height. The bulletin includes many line cuts and photographs in describing this easy-to-use gauge.

Rust Disintegrator

Is rust one of your problems? There's a new data sheet for you by Service Industries on Ferox, a heavy-duty solution which removes rust chemically. It is ideal for cleaning castings and forgings after they have weathered and cured. It is also efficient, they state, for removing rust from small threaded parts, fine tools, gauges, jigs and dies without affecting tolerances.

They further state any metal treated with Ferox is freed of all rust and is temporarily fortified against rusting under normal indoor conditions from atmospheric moisture.

Texstl, another rust preventative, Acidulum, acid-proof plastic coating and other products are also described.

Honing Handbook

New 44-page BarnesdriL honing handbook gives applications and refinements in honing techniques for selective finishes, geometric accuracy and stock removal.

The book details how honing generates diametrically round and straight bores, automatically controlling size within "tenths" and producing a pre-selected degree of finish. It is complete with tables and charts for proper speed selection for desired finishes in various materials.

Included are instructions on how to calculate the work stroke for maximum honing efficiency. Requirements for various applications of honing are described and difficult bores or surfaces are analyzed for production finishing by honing. Abrasive grades and grits are discussed, together with analysis and effects of various types of cutting fluids.

new literature

How to Get Extra Payloads

In a new folder, International Harvester points up features for extra payloads with their 24-ton "95" and 18-ton "65" Payhaulers. Included are on-the-job reports and many pictures of the units performing road, mining and quarrying operations. Specifications for the two models are listed.

Which Locomotive?

General Electric motive power surveys go a long way in telling you how to select the right locomotive for your specific haulage needs. Outlined in an 8-page folder are the steps taken by their transportation specialists in deciding the particular motive power for your job.

Heat Transfer Exchangers

Drawings highlight the Whitlock folder on their bronze and copper Hi-Transfer Exchangers. They are designed for use with internal combustion engines, compressors, molding machines, hydraulic equipment, machine tools, torque convertors and turbines—wherever cooling is needed.

Whitlock engineered design promotes high heat transfer with minimum pressure drop, they state. Stock sizes, dimensions and weights are charted. Complete interchangeability of exchanger units and parts speeds up installation and servicing.

Work Done by GE Magnetic Engineers

In a new booklet, General Electric magnetic engineering laboratory tells about its facilities for evaluating magnetic circuit designs, test methods and standards for permanent magnets. A direct result of what GE has and is doing in this field, of course, is the better use of magnets as such.

But these accomplishments can and should be translated into magnetic circuit design for other types of electrical equipment. More available data is needed on how little and how much metal can be used—and answers to a host of other questions —for specific applications.

Inside Story on Mufflers

For men who own, operate or maintain bus and truck fleets, Riker Mfg. Co. has prepared a booklet on mufflers and accessories. Called "What You Should Know About Mufflers", it points out the features and construction of their mufflers and lists the line of exhaust system accessories available. There is a section, too, on Riker Universal diesel stack replacement kits, muffler cages, couplers, hangers and other items.

In the data presented, Riker states the case for their ceramic-type coating for longer muffler life.

Transformer Upkeep Tips

Aimed at maintenance men in utilities and industrial plants, a 50-page pocket transformer guide is offered by Westinghouse Electric Corp. Called "Timely Tips on Transformer Maintenance", you can be sure this handy book covers transformer maintenance thoroughly. It gives hints on general inspection procedures and precautions, classifications of transformers, methods of drying out and transformer connections.

(*Continued on Page 68*)

The World's Leading Manufacturers of
FUEL INJECTION EQUIPMENT
for Diesel Engines

C.A.V.

FUEL INJECTION EQUIPMENT DIVISION
of
LUCAS ELECTRICAL SERVICES, INC.
Head Office: 653 Tenth Avenue, New York 36, New York
Sales Office: 14820 Detroit Avenue, Cleveland 7, Ohio
West Coast: 5025-29 W. Jefferson Blvd., Los Angeles 16, California
Canadian Distributors:
Joseph Lucas (Canada) Ltd., Head Office: 11 Davies Avenue, Toronto 8, Ontario
Branch Office: 3401 St. Antoine Street, Montreal 30, Que.

AP174-820

news of our industry

(*Continued from Page* 55)

American Design Diesel Made by Belgian Firm

Societe Anonyme Cockerill are making 4-stroke diesel engines under license agreement with Baldwin-Lima Hamilton.

The 8-cyl turbocharged engine, with 12¾ in. by 15½ in. bore and stroke, is rated at 2000 bhp at 625 rpm. This Cockerill diesel is based on Baldwin 600-type unit suitable for rail traction, marine and industrial use.

Industrial Locomotive Export Sales

In a move to modernize its sugar cane transportation system, Cuban Dominican Sales Corp. has purchased $1 million worth of industrial locomotives from General Electric. The order calls for 12 standard gauge 660-hp, 70-ton diesel electrics. They will replace steam engines now in use. The new units will haul 1300 cane cars over a 340-mile rail network between four plantations and a processing plant.

General Electric also has an order for about $½ million of industrial locomotives from Companhia Siderurgica Nacional, largest steel mill in South America. The purchase includes four wide-gauge switcher-type 100-ton diesel-electrics developing 660 hp. The locomotives will be shipped in eight months to this state-owned steel plant located in Volta, Redonda. The mill's current expansion plans will boost its production capacity from 465,000 ton to 740,000 ton of finished products.

Another order was placed with GE for $1¼ million diesel-electric locomotives by Anglo-Lautaro Nitrate Corp. of Chile. The contract calls for three 88-tonners with 1320-hp engines and eight 67-ton 660-hp locomotives. Both truck assemblies will allow wheels to be set for two different narrow gauges. The new diesel-electrics will replace steamers completely.

Fruehauf To Build Special Equipment for Trailer-Ship Firm

Fruehauf Trailer Co. has received an order for an estimated $7 million of equipment from Sea-Land Equipment Co., an affiliate of McLean Industries, owners of the Pan-Atlantic Steamship Co. The company announced it had contracted for delivery of 1740 units of trailer equipment from Fruehauf, consisting of 1,050 containers and 690 chassis.

At the company's headquarters in Mobile, Ala., Mr. McLean said the trailers are to be delivered by July 1, 1957, and are to be used in service between U.S. Gulf and North Atlantic ports aboard four conventional C-2 freighters now being converted for the hauling of truck trailers. All four ships are slated to be delivered by next October. Each is to be capable of hauling 208 fully-loaded trailers at a time, though they require approximately two and a half times that number of trailers for the purpose of providing continuous service.

FREE to Every Shop Operator

- Diesel Compression Testers
- Nozzle Testers for American Bosch, Caterpillar and Bendix Nozzles
- Cummins Injector Tester
- International Harvester Injection Testers
- General Motors Injector Testers
- Injection Pump Calibrating Stands
- Nozzle-Injector Cleaning Tools and Lapping Blocks
- Engine Overhaul Stands
- Engine Removal and Parts Dollies
- GM 71 Engine Tools

76 Pages—275 Illustrations
56 Engine Reference Tables
26 Parts Lists

SEND COUPON NOW

BACHARACH INDUSTRIAL INSTR. CO. • 200 N. BRADDOCK AVE., PGH. 8, PA.

Send us FREE copy of your Diesel Shop Manual AD54

We are: ☐ Fleet Operators ☐ Injection Service Shop ☐ Diesel Manufacturers ☐ Parts and Engine Distributors

NAME_____

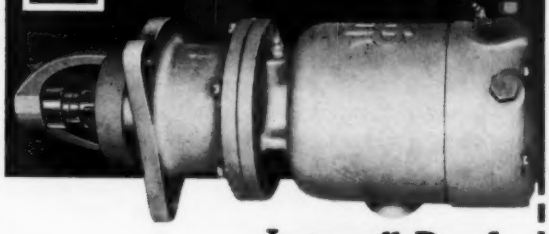
COMPANY_____

STREET_____

CITY and STATE_____

AD-15

AIR STARTING MOTORS



Ingersoll-Rand

5BM for smaller engines

eliminate weight and costs of starting batteries and generators

Dependability: fast, positive starts regardless of temperature. Proven performance. Made by the originators of Air Starting Motors.

Low Cost: compact I-R Air Starting Motors are small, powerful, easily installed. Low maintenance costs throughout long, trouble-free life.

Three Sizes: 5BM, 9BM and 20BM Air Starting Motors meet requirements of complete range of heavy-duty internal combustion engines.

Write for Bulletin 5094D

IE-543

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

news of our industry

(*Continued from Page 64*)

Hallett Purchase by American MARC Final

American MARC, Inc. has now acquired complete ownership, management and property of the Diesel Engineering Div., Hallett Mfg. Co., Inglewood, Cal.

The move, announced by W. Denis Kendall, president of American MARC, is significant to southern California and the diesel industry. It marks the entry of Arthur Vining Davis into industrial investment in that region and gives impetus to diesel manufacturing in this country. Mr. Davis is Alcoa board chairman and majority stockholder in American MARC.

Up-dating at the Hallett plant has already resulted, American MARC states, in substantial product improvement, increased production and distribution. Concentrated research has kept pace with military demands for lighter, more compact and powerful diesels for mobile generators and allied units. This policy has resulted, they report, in $750,000 in contracts from the armed services.

Taking over as chief engineer of the firm is Tom B. Danckwortt, German diesel expert well-known for his many innovations in the field. His assistant, Nickolaj Simovich, was a professor at Technical University in Karlsruhe, Germany.

Basic products of American MARC are four high-speed, lightweight, low-hp diesel engines—two 1-and 2-cyl prime movers, each available in air-cooled or water-cooled units.

Safety First—At AiResearch

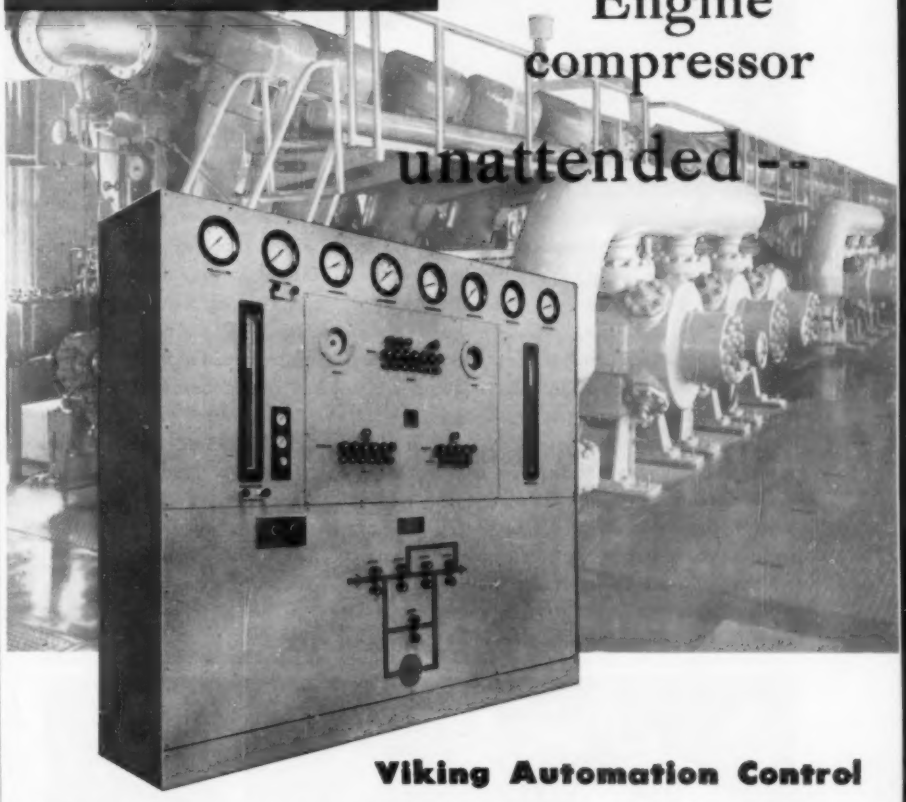
AiResearch Industrial Div., Garrett Corp. operated from June 2, 1955 to January 23, 1957 without a single disabling injury to any of its employees. This period represents 602 successive working days or a total of 482,589 consecutive man-hours—all accident free. That's a record for other plants to shoot at.

For this feat AiResearch was awarded the "Outstanding Safety Achievement" citation, the first of its kind ever given by Pacific Employers Insurance Co. in southern California.

AUTOMATION TAKES OVER

VIKING AUTOMATIC SEQUENCE CONTROL SYSTEM

runs Giant Engine compressor unattended --



Viking Automation Control

STARTS-OPERATES-CONTROLS-MONITORS and STOPS

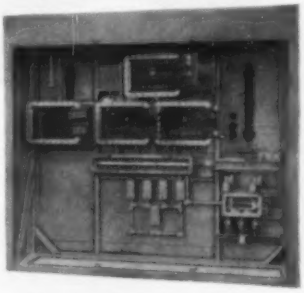
To provide an operating control system that would be completely automatic and fail-safe in starting—operating—controlling—monitoring—and stopping this 1300 HP engine compressor; Viking Instruments designed and built this automatic sequence control system for Ingersol-Rand.

Designed to permit complete, unattended, remote control operation, this Viking control system automatically operates all starting controls—brings the engine to slow speed until pressure and temperature requirements are met—then checks and loads the compressor and brings unit to full operating speed.

This control system monitors all oil, water, and exhaust-temperatures and pressures. Any abnormal condition occurring in starting or operation is instantly indicated by visible and audible alarm signals. If not corrected, the control system automatically starts the shut-off sequence by slowing engine compressor, unloading compressor and shutting down all operations.

Viking Automation engineers can design and build automation controls to your specifications, To obtain further information on this unique Viking Control System you are invited to write or call.

This control panel contains a full complement of recording gauges, indicating lights, alarm signals, and other indicators to permit continuous checking of operation, either manually or by remote control.



Rear view of control system shows circuits installed in explosion proof boxes, easily accessible for checking and servicing.

VIKING

Viking Instruments, Inc. East Haddam, Conn.

Designers — Engineers — Builders

Automation — Safety — Temperature — Pressure — Quality-Control Systems

new products

(Continued from Page 59)

Tractor Lifts 10,000-lb Load

One more job for the versatile tractor—lifting a 24-ft transport trailer. Performer here is a hydraulically-operated, 4-way tilting fork lift mounted on a Model 105, 143-hp crawler tractor with torque-converter.

Capable of lifting 15,000 lb to 14 ft, the unit is recommended by Eimco for any job requiring reach, high power and maneuverability.

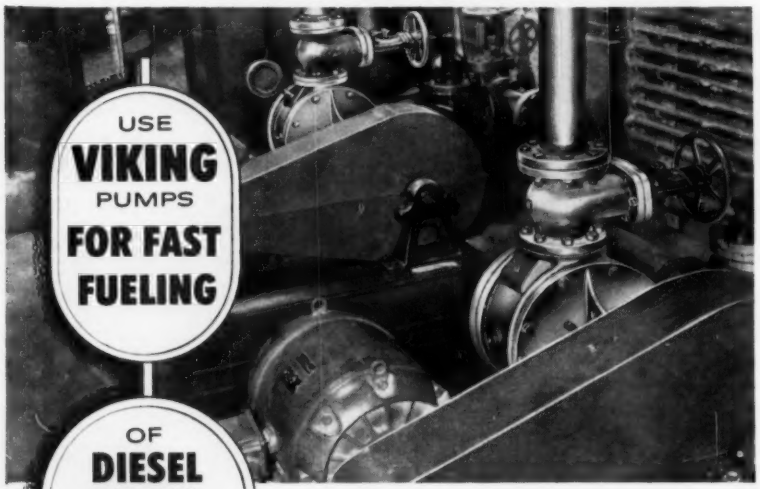
For greater visibility and work control, the Eimco fork lift seats the driver at the front of the machine. Uni-drive transmission with independent track reversal for spin, gives the fork lift versatility and operating ease even in close quarters. Tines of the lift are readily movable to fit various widths of bins, pallets or bundles.

Diesel Fuel Oil Additive

An effective sludge dispersant for diesel and other fuels has just been announced by DuPont. According to recent tests made by that firm in industrial plants and other installations, this Fuel Oil Additive No. 2 prevents sludge from forming in tanks and gummy residue from clogging filters and nozzles.

In a specific power station case, the 12,000-gal storage tanks had to be cleaned periodically. Then they tried cleaning the tanks with fuel containing the additive by circulating the mixture for 48 hours. Afterwards no sludge was found in the bottom of the tank, DuPont reports, and continued use prevented new sludge from forming.

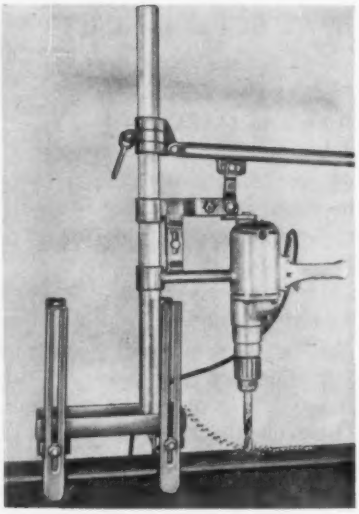
Strainers protecting the pump previously had to be cleaned every 48 hours. With the DuPont additive the strainers remained clean after five weeks' operation.



To meet close schedules, it is important to have fast, positive fueling of diesel train engines.
Fast fueling is assured when you install positive Viking rotary pumps, like these two 200 GPM Viking Heavy Duty diesel fueling pumps at an eastern railway terminal.

For complete information, ask for Catalog Cd today.

VIKING PUMP COMPANY
Cedar Falls Iowa U S A In Canada it's "ROTO-KING" pumps
See our catalog in Sweets



Portable Tool For Heavy-duty Drilling

For field erection or plant modifications requiring heavy-duty drilling, there's a new radial drill press made by Lance Iron Works. Portable, the tool eliminates necessity for handling large pieces, for lugging unwieldly tools to the job or for turning work to be drilled, countersunk or tapped.

Of all-steel construction, the unit is easily carried, operated and controlled by one man. It swings in a 360-deg radius, is adjustable horizontally or vertically and clamps and rolls on any size, shape or type of metal or wood with a safe, sure grip, Lance states. Designed for all standard, heavy-duty portable drills—either electric or air-operated—it can be used in all positions—vertical, horizontal, overhead or flat.

Dry Acid Rust Remover

Oakite has introduced a new powdered acid which removes rust, scale and corrosion with greater safety, they state, to both metal surfaces and personnel. Termed "Drycid", they describe it as having the working properties of a liquid and the handling and storage advantages of a powder, and it's non-fuming.

Added to water in concentrations upwards of 8 oz per gal, Drycid is said to dissolve fast and be useful in applications by circulation or immersion. Solutions may be used cold or for quicker action, heated to 165°F.

organizational news

(*Continued from Page* 61)

Robert G. Hill

Leece-Neville Sales Post

Robert G. Hill has been appointed sales manager of the Original Equipment Div. of Leece-Neville Company. Mr. Hill first joined this firm in 1941 as a tester.

Garrett Appointment

Formerly senior project engineer, Wilton E. Parker, has stepped up to asst. chief engineer for AiResearch Industrial Div., Garrett Corp. Mr. Parker is now responsible for all engineering activities for turbochargers and pressure ratio controls for industrial gas turbine engines, and other related items.

John Lundahl

Detroit Diesel Distributor

Western Engine Co. has been appointed distributor for GM, Detroit Diesel Engine Div. and will handle that Division's line of two-cycle diesels in Chicago and northern Illinois. The distributor is a new corporation formed for the sale and service of industrial and marine engines, exclusively.

Officers of the company are Hugh Scott, chairman of the board; John Lundahl, president and general manager; Gilbert Weidlick, vice president, and Hugh Scott, Jr., secretary and treasurer. Robert Bowles has been named engine sales manager while R. Roschert and E. Schneider head the parts and the service departments, respectively.

Arthur N. Haar

Clark Appointment

Arthur N. Haar has joined Clark Bros. Co. as western regional sales manager for industrial sales. He will make his headquarters at the Clark Chicago office. Mr. Haar's background includes ten years' experience in the industrial air compressor field.

Richard L. Gates

Sterling Engine Announcement

Sterling Engine Co. has appointed Richard L. Gates chief engineer. Mr. Gates was formerly senior design engineer with Auto-Lite and is still a member of the board of directors of that firm. He is a member of the SAE.

Bosch Expands

Robert Bosch Corp. in an expansion move is constructing a building in Long Island City, N. Y. It will house sales and administration quarters and provide shop and laboratory facilities. Recently the company opened a branch in San Francisco for servicing the western states.

Alco Revamping Plant

Alco Products, Inc. intends converting its "west side" plant into what they term the "most modern and efficient locomotive manufacturing facilities in the country".

As a first step in effecting consolidation and economies in operation, Alco is selling or leasing one-third of their "surplus" buildings on its 113-acre Schenectady site.

Currently, Alco is completing a $74 million contract for 900 M48-A2 medium combat tanks in th's "surplus" section.

Pistons after half-way immersion in Oakite Saturol. Notice how this powerful solvent cleaner reaches into grooves.

Dissolve carbon, grease, gum . . . in minutes . . . with new Oakite SATUROL

This brand new solvent cleaner is just about perfect for cleaning pistons, valves, filters, gears and other small diesel parts. A brief immersion in Oakite Saturol melts off everything—carbon, grease, paint, gasket compound . . . leaving the metal clean and bare.

Parts to be cleaned are immersed in the solvent for ten minutes to half an hour depending on condition, then rinsed off with kerosene or water . . . and that's all there is to it. Oakite Saturol has a floating vapor seal that assures long life and economy. High flash point and safety on all metals are extra advantages.

Besides large and small drums, Oakite Saturol comes in a special 6-gallon trial pail, complete with immersion basket. Ask your local Oakite Technical Service Representative to demonstrate, or write for more details to Oakite Products, Inc., 22C Rector Street, New York 6, N. Y.

OAKITE

Export Division
Cable Address: Oakite

Technical Service Representatives in Principal Cities of U. S. and Canada

new literature

(*Continued from Page 63*)

Oil Purification

Utility and municipal engineers concerned with transformers and distribution systems will be interested in Bulletin 10-107 describing De Laval Centrifugal oil purifiers. The folder discusses how these purifiers work and gives complete dimensions, capacities and specifications on the various types and models.

Induction Heating Equipment

If you are concerned with induction heat treating and hardening of diesel and accessory parts, there's a new Westinghouse bulletin for you.

Well illustrated, the bulletin describes the construction, operation and application of high-frequency motor-generator sets and accessories for induction heating. Also, m-g set cooling systems are explained along with cooling of various transformer and capacitator accessories.

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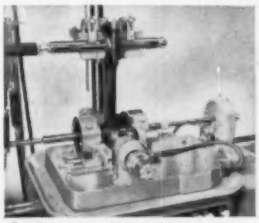
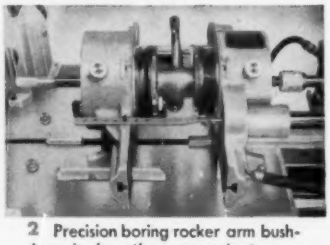
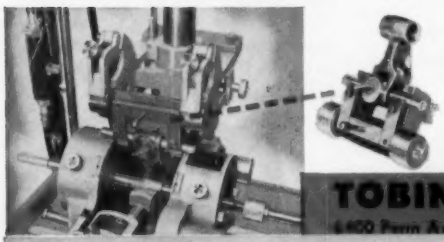


1 Precision boring piston pin bushing parallel with crank pin bore, to specified center-to-center dimension.



2 Precision boring rocker arm bushings in *less than one minute* per rocker arm.



3 Precision boring cam lever bushings, parallel with roller shaft to specified center-to-center dimension, with Vernier Scale Control.

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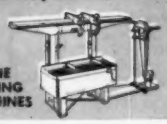

LINE BORING MACHINES

How to Select Proper Power for Pumping

Caterpillar Tractor Co. has readied a handbook, "Selecting Power for Pumping". It contains a checklist of features and requirements which an engine must have for continued efficient operation on pumping jobs. Photos are shown of various pumping installations.

Versatile A-C Grader

Allis-Chalmers has issued a 16-page run-down on Model 45 motor grader powered by ADS-516 diesel engine. Pictures and sketches help visualize working advantages, mechanical features and components. Listed with specifications are special attachments and accessories which add to the versatility of the unit.

GM Hydrostarter

In a new leaflet, Detroit Diesel Div., GM, tells about the features of its improved Hydrostarter. This GM hydraulic system, they state, provides instant starts for diesels, whether in the arctic or desert, and eliminates maintenance costs of batteries, cables, magnetos and air compressors.

Right and left-hand starter units are available for mounting on equipment cab walls, running boards or wherever most convenient. Reserve capacity for extreme conditions is possible by providing more than one accumulator.

Electromagnetic Controls

Automatic Switch Co. has done a comprehensive job in presenting its long line of electromagnetic controls in a 170-page catalog. You name it and they have it—indexed and thoroughly detailed down to list prices. The six sections are available bound in one booklet or separately. They are: Automatic Transfer Switches; Remote Control Switches; Contactors; Relays; Solenoids, and Electric Plant Controls.

Section 6, for instance, pictures and describes diesel starting panels, coded by catalog number and circuit diagram to the type and make of engine with which it will be used.

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Service Section

Waukesha (*Cont'd from P.* 51) or junction of the stem and underhead radius." Mr. Young then stated the various factors that contribute to excessively high seating velocities. Chief among them was excessive valve clearance.

The effect of this factor increases with increased engine speed, it has the same actual effect as a worn cam. For this reason it is much more important than the single factor of overspeeding as it is present at all engine speeds. It will most likely lead to valve damage even though the engine is never operated at excessive speed.

In a letter to the AERA, one of their members says: "We certainly agree with your Technical Committee in that overspeeding is to be avoided and that worn camshafts will cause the difficulty even though the valve clearance is properly adjusted. We do believe, however, that improper valve clearance will be found to be the major contributing factor in this type of failure. Truck operators in particular are very aware of, and concerned with, the problems created by insufficient valve clearance. The result is to set clearances too wide, without a complete realization of the dangers inherent in this variation from the specifications recommended by the engine manufacturer."

AERA (*Cont'd from P.* 51) the tool and the shaft, and excessive tightness will cause the tool to bind.

The drilled hole dimensions suggested will allow adequate room for adjustment on the crankshaft to flywheel dowels. The three 9/16-in. holes should be used in conjunction with the flywheel capscrews to draw the tool down evenly against the seal. This technique offers less likelihood of damage than driving the seal into place with a hammer.

4. Apply a light coat of seal lubricant to cork face, using a light mixture of graphite-oil-kerosene.

5. Install rear oil retainer #135090 with gasket #74709. Check the oil pan to retainer gasket, as well as other gaskets, before tightening pan.

6. Install flywheel, operate engine, and check for leaks.

news of our industry

(*Continued from Page* 65)

Marketing Move at M-M

Minneapolis-Moline Co. reports moving toward a stronger position by emphasizing marketing, increased production and greater sales and service through bigger and better offices and dealerships—and more of them.

Latest move is the opening last month of new factory sales and service branch in Atlanta with William M. Reddig in charge. This branch, with 39,200 sq ft, will be wholesale and retail headquarters for M-M's industrial equipment line. In January, consolidation of divisions moved farm equipment sales personnel from Atlanta to Harrisburg.

Recently Minneapolis-Moline also added other factory sales and service branches at Denver, Oklahoma City and Lansing.

The firm is now adding to its line of irrigation equipment, including pumps and related products, and their first crawler tractor is scheduled for production in August.

What Do You Know!

(*Answers to Questions on Page* 29)

1. Correct answer is "a". By finding the ignition time lag of the sample fuel and then comparing it with the known ignition lag of a reference fuel, the cetane number of the sample fuel can be determined. See the article on Page 28.

2. Correct answer is "b". Lube oil must lubricate, clean and cool. It must meet the requirements of highly-stressed valve gear mechanisms (tappets, etc.), gears, etc., as well as the requirements of bearings. See Page 30.

3. Correct answer is "b". It has been figured that increasing diesel engine output with a turbocharger costs about ¼ to 1/3 per horsepower as the cost per horsepower of the basic engine. This is a cheap way to buy horsepower. See article on Page 34.

4. Correct answer is "b". By proper arrangement of ports in the liner, the air charge from the crankcase may be higher than atmospheric pressure. See the system used in the Fiedler 2-cycle diesel engine discussed in the article on Page 36.

5. Correct answers are "b and c". The heavier the lube oil the less number of drops per pint. Density of the liquid in the sight feed also controls drop size. See article on Page 42.

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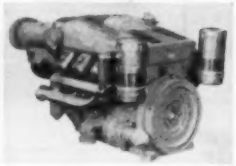

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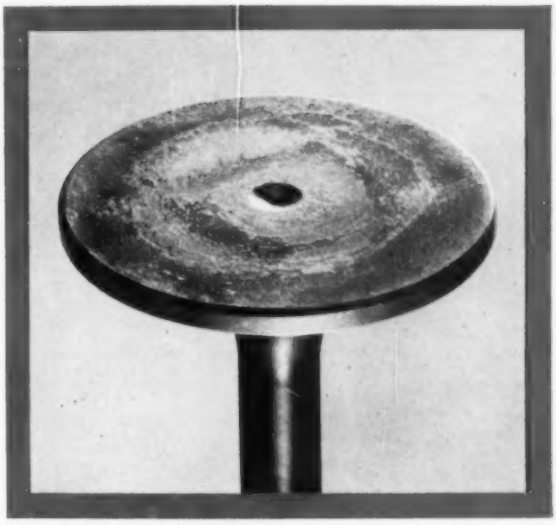

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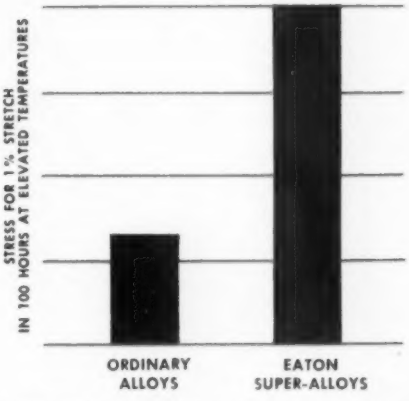

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Neodesha packs 1-2 performance punch

1 | *Nordberg Diesels* 2 | *STANODIESEL Oil M*

Operator J. N. Finkinbinder (left) and Everett Powell, Neodesha Superintendent of Electric and Water Plants, adjust rocker arm assembly of Nordberg Duafuel Engine. Engine operated 40,431 hours before overhaul, carrying about 90% of load. All engines in service at Neodesha are Nordberg's. All use Standard Oil's STANODIESEL Oil M.

Finkinbinder and Powell inspect oil filter used for filtering STANODIESEL Oil M used in all six Nordberg Diesels at Neodesha, Kansas, power station.

Quick facts about STANODIESEL OIL M

- Keeps crankcase, pistons, cylinder walls clean.
- Combats deposit and wear problems imposed by using economy fuels.
- Maintains film on difficult to lubricate parts.
- Eliminates spark plug fouling in spark-ignited gas engines and reduces combustion chamber ash and deposits in engines burning natural gas, LPG and liquid fuels.
- Eliminates fuel injector and pump sticking caused by deposits on injector barrel and plunger where fuel and lube oil mix.

The city of Neodesha, Kansas, has six Nordberg engines in service. They have operated more than 400,000 hours on Standard Oil diesel lubricating oils. Here is the case story of one of these engines. The performance of this engine is typical.

In 1952, the city of Neodesha installed a 1,750 hp., 1230 kw., Nordberg Duafuel engine. During the period between February 14, 1952, when the engine went into service, and March 1, 1956, the engine ran 34,370 hours out of a possible 35,784. This is 96% of the engine's total installed hours. In this time, not even a piston or cylinder head was removed. So good was the performance of this engine using STANDARD HD Oil that when Standard introduced an improved diesel oil—STANODIESEL Oil M—in February, 1955, this engine was converted to this new oil.

There is more to the story. The engine continued in service to 36,223 hours when No. 7 cylinder liner was pulled to put rubber gaskets on liner to stop water leakage. At this time, No. 7 piston and liner were checked. Liner wear averaged only 0.0045 inches. The top ring showed an average wear of 0.016 inches. The No. 2 ring was 0.020 inches. Little, if any, wear was indicated on other rings. Now, at 40,431 hours, the engine is down for overhaul of turbocharger and to have valves ground. Bearings were found in excellent condition. No pistons are to be pulled.

Get more facts about STANODIESEL Oil M by calling the Standard Oil office near you in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

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